UNITED STATES ARMY

OCTOBER 1969

# AVIATION DIGEST

# UNITED STATES ARMY AVIATION DIGEST

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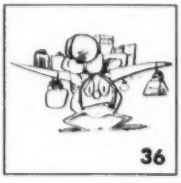


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**The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.**

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**Articles, photos, and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, U. S. Army Aviation Digest, Fort Rucker, Ala. 36360.**

**Use of funds for printing this publication has been approved by Headquarters, Department of the Army, 3 November 1967.**

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# VIEWS FROM READERS

THE STORY "Do You Really Know the UH-1?" that ran in the July issue of the AVIATION DIGEST drew quite a bit of attention from old Huey pilots as well as from non-rated people in various places and jobs. One reader, CW3 Billy J. Smith of the U. S. Army Aviation School Element at Hunter Army Airfield really scrutinized the story. He wrote—

Sir:

Reference your July issue and the article "Do You Really Know the UH-1?" My first comment is "Yes, I think I do." . . . In trying to answer the multiple choice questions I find the authors did not list a correct answer for for No. 3 [which read as fuel is consumed during flight the center of gravity of the UH-1D will:] The answer selected by the authors was b [move forward]. When I tried to check this out using the reference listed, I found this —10 to be for the UH-1B (TM 55-1520-219-10) and not the UH-1D (TM 55-1520-210-10). Shame on you!

Also, in reference to question No. 3, TM 55-1520-210-10, dated May 1969, and TM 55-1520-210-10, dated November 1967, chart E—Loading Data (Fuel Loading Tables, Regular) show that with a full load of 220 gallons (1,430 pounds) the CG is 151.6. As fuel is decreased down to 85 gallons (553 pounds) the CG moves to 127.1. From 85 gallons (553 pounds) down to 10 gallons (65 pounds) the CG moves aft to 144.0. As CG of the fuel load changes the CG of the aircraft must change. This can be proven by the computation of three 365-Fs with the three fuel weights given above. Therefore, the answer to No. 3 must be that it [the CG] moves forward for a portion of the flight and then moves aft till the fuel is exhausted.

The readers at Hunter AAF [also] would like to know the authors' answer to question No. 20. It seems to be omitted from the article.

**• You're right on all counts. The wrong reference was given for question No. 3. It should have been TM 55-1520-210-10 instead of TM 55-1520-219-10. This makes your answer to question No. 3 correct. The fuel loading tables clearly show that as fuel is consumed the CG moves forward and then aft. The answer to question No. 20 is as follows: "The handling qualities of the UH-1 helicopter at speeds less than 60 knots are not considered compatible with instrument flying."**

**Another letter recently received concerned the need for wider dissemination of functional maintenance information. SP6 Paul D. Graver of Co B, 15th TC Bn (AM&S), 1st Cav Div (Air) points out this problem which we also have been aware of for some time.**

Sir:

Possibly this letter will be food for thought for your editorial staff.

The AVIATION DIGEST is an outstanding publication for the Army aviation program especially for aviators and aircrews, but it leaves a gap in covering shop safety, information and news from the aviation maintenance field.

Possibly consideration could be given to a publication similar to the Navy's "Mech" magazine. A publication of this type would give the people who work in the field of aviation maintenance a magazine devoted to their speciality.

As a career soldier and aviation maintenance man (rotary wing technical inspector) any means of spreading the word on shop type safety, new equipment and lessons learned by others in the aviation maintenance field appeals greatly.

With the present format of the AVIATION DIGEST appearing to lean toward the operational and managerial aspects of Army aviation the aspect of maintenance information seems to get lost in the shuffle.

Perhaps the idea of an Army aviation maintenance magazine may never be developed for one reason or another but the need is evident.

Any attempt at increasing the dissemination of information directed at the personnel in the aviation maintenance field would be a step forward.

**• We agree that more maintenance material is needed in the AVIATION DIGEST. The problem could be partially resolved if those who are involved in aviation maintenance would submit such articles to the DIGEST. If more maintenance people would write stories, we could print more maintenance articles. It's as simple as that.—The Editors**

**Here is a letter from Captain Gene R. Williams, U.S. Army Adjutant General School at Fort Benjamin Harrison. Captain Williams has some clarifying info about the pinpoint distribution system.**

Sir

Your answer to the first question on page 9 of the July 1969 issue of AVIATION DIGEST does not completely address the problem. The procedure you recommend is fine for resupply of these publications, but the main idea is to insure initial recipt of these checklists immediately after publication.

The Army has spent a great deal of time and money publicizing the pinpoint distribution system but, as shown in this example, some units still are not aware of it. This lack of knowledge causes loss of time in initial receipt of publications, reliance on the resupply procedures outlined in your answer and increased workload for all concerned.

In this case, the unit should first check to see that it has current publications accounts with the USA Publications Center at Baltimore, Md., and St. Louis, Mo. If so, the unit should next insure that the appropriate "dash-numbered" portion of the DA Form 12 series has been filed. Information pertaining to both procedures may be found in DA Pamphlet 310-10, Guide for Publications Supply Personnel, dated February 1969.

Use of the pinpoint system will insure that all units receive their publications at the earliest possible moment. Procedures listed in your answer should be used only as a last resort.

**• You are correct in stating that procedures outlined in the July issue of the DIGEST should be used only as a last resort in obtaining publications under the pinpoint distribution system. However, if units have current publications accounts with the Publication Center, St. Louis, Mo., and have completed and forwarded DA Form 12-31 and are not receiving the checklist, the DA Form 17 should be completed and submitted. Thanks for your letter and your interest. Units following the procedures which you have outlined should receive checklists and changes as soon as they are published under the pinpoint distribution system.—The Editors**

**The "people sniffer" triggers the first stages of a new and successful combination of the classic tactics of reconnaissance and encirclement. Dubbed "Jitterbug" and "Seal" operations by the 9th Infantry Division, the new methods provide the capability of trapping the VC and then pounding him**

# GANG TACKLING . . .

Lieutenant John F. Lamm

THE UH-1D HUEY almost clipped the treetops as it snaked along a wooded streamline. Inside the speeding craft, a sergeant sat intently watching the needle on his "people sniffer." It had bobbed hypnotically in the low range for over an hour when it suddenly leaped to maximum reading.

"Maximum," he told the pilot over the intercom, "let's check it out." The pilot whipped his craft up and around, doubling back over the same spot. Again the needle made a sharp jump.

"Positive reading," reported the sergeant. The target was confirmed. The pilot quickly got on his radio to initiate the second stage of the operation.

Light observation helicopters buzzed low behind the sniffer ship, hugging quizzically over the suspected area, spreading the nipapalm with their rotorwash and straining to detect movement.

Out of the corner of his eye, a crewchief saw an arm quickly emerge from the swaying vegetation and disappear. The chopper slid over the spot and dipped lower. A burst of AK-47 fire flashed past the chopper.

# THE VC

Reacting instantly, the LOH returned fire and hopped nimbly out of the way, calling in the two AH-1G Cobras poised high above waiting to strike. At the call, the shark-like helicopters attacked, raking the area with minigun and rocket fire.

Simultaneously, five kilometers to the east, an infantry company of the 9th Infantry Division was in an Eagle flight. Five slickloads were on the ground sweeping an intelligence target with no luck. Another five slickloads circled nearby as a ready reaction force. When the call came that the Cobras were in contact, the reaction force left its orbiting position and headed for the new target area. The sweeping element moved to a predetermined rendezvous point to wait for extraction and movement to the contact. A few minutes later they hit a new landing zone near the target area and moved in as a blocking force.

This chain of people sniffer, LOHs, Cobras and infantry is part of the first stages of a new and successful combination of classic tactics: reconnaissance and encirclement.

The new methods, known in the 9th Div as "Jitterbug" and "Seal" operations, have virtually shattered the grip of the Viet Cong (VC) main force units on the people in the northern Delta.

Such a combination was needed to overcome major problems never encountered daily by American forces. Not only did they face an elusive guerrilla force, but some of the world's toughest terrain—that of the Mekong Delta.

Mud in the Delta is a slimy, sucking, unforgiving trap for the infantryman. It holds him fast when he has to move. It fouls his equipment and quickly saps his strength.

The water that brings the mud is equally damaging. Besides being uncomfortable to work in constantly, it breeds a skin disease called dermatophysis. Combined with immersion foot, this fungal disease can incapacitate a man with alarming speed. The fast-paced airmobile tactics eliminate such constant exposure to water.

The Delta also poses a fire control problem because of the high population density, and commanders must be skilled and alert to avoid injuring civilians. They must remember, however, that the VC can easily blend with the civilian population.

For all the problems it causes, the clear, flat Delta region has one major asset as far as Seal operations are concerned. It can be described as one huge landing zone, making it possible for commanders to quickly hop troops from one area to another and to place the soldiers exactly where needed.

The ultimate result is localizing the VC in streamlines and patches of nipapalm. It confines them to a definite area which can be pinpointed and surrounded.

Colonel Henry E. Emerson, former 1st Brigade commander and innovator of Jitterbug and Seal tactics used in the Delta, explained the advantage of his methods, "It gives us the capability of trapping the VC and then pounding him. It takes a lot of practice and coordination, but it ultimately enables us to find and annihilate an entire battalion."

When initial contact is made by the ground troops, the first step of the Seal process begins. Trying to draw the VC into a fight, the ground troops have to help the battalion commander determine the exact size of the VC force.

The presence of automatic weapons is an excellent benchmark. These weapons are usually found in units of at least squad size, and if there is a squad in contact the chances are good there is a larger unit in the tree line or nearby.

Next, the second set of slicks moves into position on what appears to be the best lane of escape for the enemy. In nearby battalion basecamps, standby and even standing down soldiers are filling magazines and canteens and checking radios.

By now, the brigade commander is also circling overhead and usually determines whether or not to muster the rest of the brigade for a "pile-on." If he says go, all helicopters available are pressed into service and troops are poured into the area.

As they come in, the brigade

Air scoop and hose (arrows) on a "sniffer" ship

commander first cuts off the avenues of escape and then fills the gaps in between. If soldiers are not readily available, artillery and gunships are used to keep the VC off these lanes.

If the encirclement begins in the latter part of the day, this can, and has, meant soldiers advancing on tree lines far into the night.

Each slickload lands far enough from the contact area to keep the troops from being brought into contact before they can spread out along the perimeter and fill their gap.

While the Seal is taking shape, artillery and air strikes begin. Guided by a forward air controller, the jets pinpoint their bombs on the entrapped enemy.

When all companies are in and the Seal begins to tighten, bombardment with tactical air becomes more difficult. Often the circle is just too tight to call in air strikes without endangering the troops and artillery alone does the pounding. When it gets that tight, the supporting batteries have to register tube by tube. In many cases the commander of the supporting artillery battalion personally calls the shots.

The C-47 flareships are called in when it gets dark to make it easier to adjust artillery and to prevent the VC from slipping through any holes that might result if the Seal is not complete by nightfall. Illumination continues throughout the night.

As the encirclement progresses and the ring tightens, the brigade commander periodically pauses in the bombardment and offers the trapped enemy the chance to surrender. Using both hand-held bullhorns and helicopter-mounted 1,000-watt loudspeakers, Vietnamese interpreters and Tiger Scouts (9th Division's name for a Kit Carson Scout) explain to the VC that they are completely cut off and to continue means sure death.

A "sniffer" machine mounted in the center of a Huey

Throughout the night, as parachute flares lazily drift down from the flareship, the infantrymen lean against the slimy rice paddy dikes watching for any possible escape attempt. Concertina wire is suspended across streams from a rope and secured on both sides by engineering stakes.

At sunup the companies begin an organized sweep of the area. In many cases it is only to count bodies. Other times they may meet scattered resistance from a bunker that has somehow escaped the hundreds of rounds of artillery that have been dumped into the doughnut hole. Sometimes the enemy will stumble out to surrender, the will to fight gone.

This may end it. The troops may load on slicks or CH-47A Chinooks and head back to their basecamp. If the action took place near a village and buildings were damaged, the brigade psychological operations officer may be there making on-the-spot payments for damaged homes, dead livestock or missing rice, regardless of how the damage occurred.

In some cases only part of an enemy unit has been caught and the escape trails of the larger unit can be found and followed. If so, the brigade will probably begin chasing the enemy. In some cases, such as the battles in the Plain of Reeds and northeast of Tan An, the chase can go on for four or five days before enemy units are finally trapped and virtually eliminated.

Like any precision operation the encirclement requires a lot of experience—and some luck. One of the classic examples of the Seal operation is the battle in the Plain of Reeds.

Only an occasional canal or small tree line break can be seen on the vast, flat area known as the Plain of Reeds. For years it was a haven for the VC, but now it is nothing but miles of stagnant water and rotting vegetation.

The 1st brigade's 2nd Battalion, 39th Infantry hit a hot landing zone, 1 June and started an encirclement and chase that set a pattern for future operations.

For four days the brigade pursued three major VC units, finally trapping them in a tree line on the southern edge of the plain.

The 2nd Battalion, 39th Infantry along with the 2nd Battalion, 60th Infantry; 4th Battalion, 47th Infantry; and Vietnamese Civilian Irregular Defense Group soldiers surrounded the VC and killed 192 enemy bringing their three-day total to 233.

# SMOKE

## A TACTICAL CONCEPT

Major Matthew R. Kambrod

WHERE THERE'S smoke there's not much fire—at least a lot less *gunfire* menacing the 269th Combat Aviation Battalion during assault operations in the Republic of Vietnam.

The smoke is provided by one of the 269th's specially rigged aircraft to screen operations and has sharply reduced the number of hits received from enemy gunfire.

The 269th's smoke lineage goes back to August of 1967 when a UH-1C, fitted with a smoke generating system, was assigned an experimental mission of escorting assault helicopter companies into various selected landing zones. Several early operations in conjunction with the lift companies definitively established that the smoke emitted by the smokeship served as a highly effective visual barrier between suspected enemy locations and an approaching helicopter force. Initially it was extremely difficult to determine the extent of the benefit derived from the employment of this ship in such a role. However success was evidenced by the lack of hostile fire received by helicopters coming into an enemy occupied landing zone (LZ). This was sufficient assurance that the battalion possessed an effective defensive capability.

Early in the development of smoke tactics it was found that close coordination between the smokeship and the supporting gunships was imperative. A visual reconnaissance of the planned landing zone, though not of absolute necessity, was of much benefit prior to a smoke run. In the battalion's operations, the smokeship whenever possible would reconnoiter the area with the gunships under the scrutiny of the command and control aircraft. This method or system best assured that maximum coordination and understanding of the assault plan had been attained.

Once the smokeship crew was briefed on the LZ location, the direction of flight of the

airmobile force, the suspected enemy location and on the area the ground commander and the air mission commander desired screened, they would return to the release point and orbit while awaiting the troop carrier aircraft. Upon their arrival the smokeship would position itself abeam the lead ship on the approach to the LZ. Coordinating with the gunship leader, the smokeship would at this time descend to ground level in position for the smoke run. Timed just ahead of the airmobile assault force and just behind the leading gunship escort, the smokeship would lay the smoke screen.

When the smokeship was employed in four early operations in areas where the battalion had habitually drawn heavy fire, the airmobile force did not once report receiving fire.

However in one operation, due to a lack of intelligence and unsatisfactory wind conditions, smoke was not utilized as effectively as it might have been. In this instance fire was received from the unscreened side of the landing zone. It is felt that due to the width of the LZ the smokeship should have sealed both sides of the landing area. This was realized too late, however, but was henceforth given full consideration in all operations with similar existing conditions.

The employment of the smokeship was further explored by a ground commander as a diversionary tactic. Supporting the 1st Brigade, 25th Infantry Division, the smokeship could not be practically utilized in the assault phase of the airmobile plan due to unsatisfactory wind conditions. To insure full use of all his available resources, the ground commander requested that the smoke aircraft be used in a diversionary role by sealing the periphery of a town on the approach course of the inbound airmobile force. The primary intent was to divert the attention of the enemy, thus creating the question of the exact location of the landing zone. Not only was this accomplished, but also, by hampering the vision of the enemy forces positioned along tree lines surrounding the hamlet on the approach course, the smokeship very effectively afforded added security to the entire flight.

Again, on an operation supporting the 1st Brigade, 25th Infantry Division, the smokeship, in conjunction with gunship teams from the 116th Assault Helicopter Company, was used most effectively in the support of ground troops in the western zone of the brigade's area of operation.

A battalion from the 1st Brigade was air landed parallel to a north-south tree line through which the unit was to advance to the east to conduct a search and destroy operation through two wooded areas. The first heavily wooded area extended 1,500 meters to the east, after which a clear area, rectangular in shape, running north and south approximately 900 meters wide, was located. The infantry moved to the east edge of the first wooded area and halted.

At this time the 116th's gunships made a suppressive run from north to south down the centerline of the open area. The smokeship, on the deck, made its first pass immediately behind the gunships. A wall of smoke now separated the infantry from Viet Cong elements occupying the tree line to the east, the second objective of the infantry battalion.

The infantry rapidly advanced to the smoke and dropped behind a series of 2-foot rice dikes. Before the smoke could dissipate the gunships attacked the far tree line, the infantry's second objective. The smokeship made a second run, again from north to south and behind the guns, on the western edge of the second tree line. Sealed again by a solid layer of white smoke, the infantry advanced and reached the next wood line, never once affording the enemy the luxury of a point target. With no significant resistance the ground forces were able to close with and destroy the enemy.

Given free rein on many assaults conducted in support of units frequently worked with, smoke pilots developed numerous techniques for employing the aircraft. Frequently the smokeship, approaching the landing zone from a direction opposite to the final inbound heading of the liftships, would smoke the downwind side of the LZ, seal the rear of the flight and continue the screening of the upwind side as the slicks pulled pitch. This horseshoe technique proved highly effective, especially in opera-

# Smoke—A Tactical Concept

tions wherein infantry forces were being extracted from hot LZs. In such situations coordination and timing were absolutely essential to avoid having the smokeship inadvertently shot up by aggressive door-gunners laying down suppressive fires.

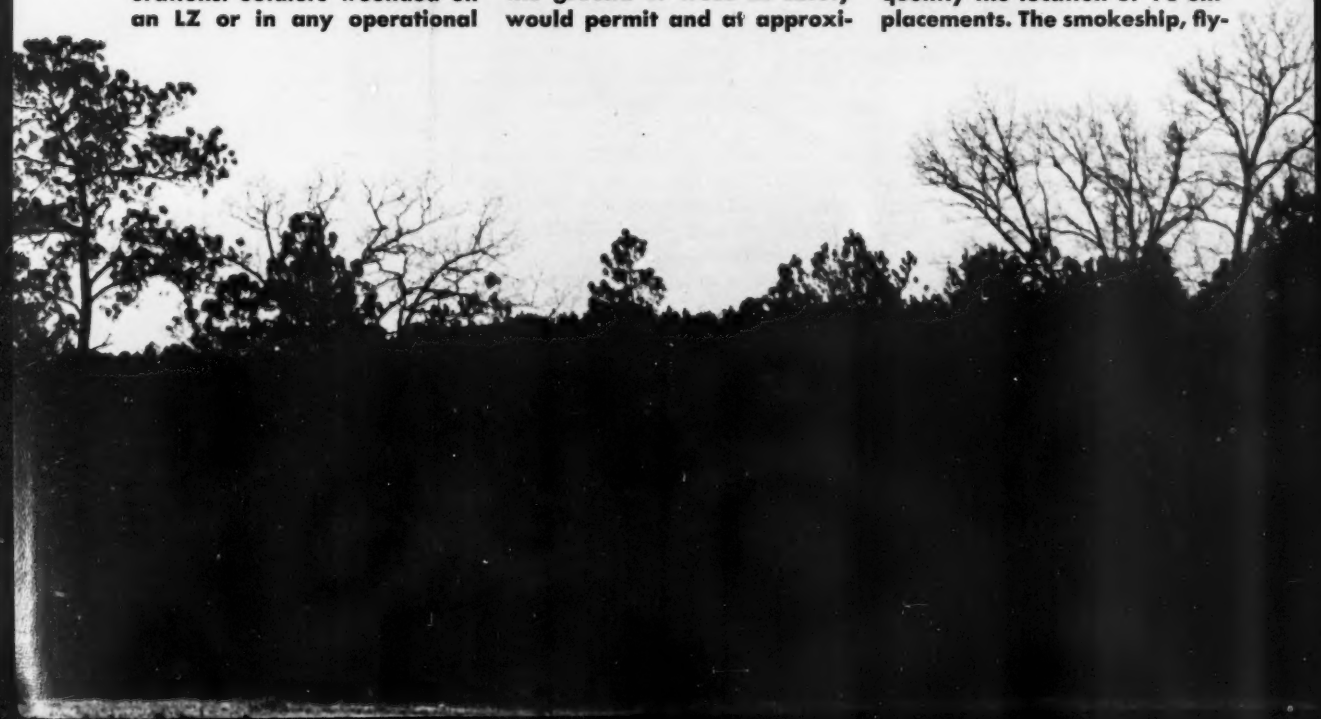
As smoke operations continued to develop, the smokeship became so much a part of infantry assault helicopter operations that the aircraft was continuously requested to support air assaults throughout the corps area and figured substantially in ground commanders' operations orders. So successful had the concept become that smoke pilots were logging in excess of 100 hours each month. The aircraft's daily itinerary consisted of continuous shuttling from the landing zones of one operational area to those of another.

The smokeship, however effective in combat assaults, truly endeared itself to the infantrymen in medical evacuation operations. Soldiers wounded on an LZ or in any operational area were afforded a more secure evacuation when the smokeship was available to screen the LZ to hide the Dustoff inbound for the pickup. Dustoff pilots also were most appreciative of the services rendered.

Within four months of operation, the techniques for employment of the smoke aircraft were established. Unquestionably, prime consideration had to be given to wind direction and velocity. The importance of this certainly will be confirmed by anyone who might have been involved in the few early occasions when a miscalculation suddenly rendered the LZ IFR.

Altitude and airspeeds were also critical in effective smoke operations. Smoke runs above 20 feet absolute and in excess of 100 knots were found to be unsatisfactory. Winds coupled with the limited smoke density caused by a high airspeed left the mission almost ineffective. The most benefit was derived from a run made as close to the ground or trees as safety would permit and at approximately 80 knots. This technique guaranteed that the smoke density was sufficient to preclude its dissipation for at least 15 to 20 seconds, the time required to clear an LZ.

Especially effective was the employment of smoke along canals and river banks, frequently the location of VC emplacements. The smokeship, fly-



The crew of the 269th Combat Aviation Battalion's original smokeship are (from left to right) SP5 Paul Geving, LTC James H. Merryman, MAJ Jack McKnight and SP5 Philip Busby

ing beside the brush growth along a bank could lay smoke on water where it would be retained for lengthy periods. A canal could be smoked down its banks, down its center or at a given distance from it, depending on the suspected enemy situation. In each case the smoke would render the fire received from the gun positions ineffective in that point targets were again denied the Viet Cong.

The principle in the mechanics of smoke emission are quite simple. Two 55-gallon bladders are laid parallel across the floor of a UH-1C. The bladders are filled with fog oil, a petroleum composite similar to 10-weight motor oil. The fog oil is pumped through tubing to a metal ring emplaced around the circumference of the aircraft's exhaust. As the oil is pumped to the ring its flow continues through jets into the intense heat of the exhaust gases. The oil is vaporized immediately and smoke billows to the rear of the ship.

As the rear bladder empties, the auxiliary fuel pump switch is activated, transferring the fog oil from the front to the rear tank. The entire load of oil on board provides approximately eight minutes of smoke emission. Eight minutes is a considerable amount of time considering the brief time span required to run an average LZ in the III Corps area.

The smokeship is a relatively new product of Army aviation's counterinsurgency role in Vietnam. After many months of continuous operations, the smokeship concept is beyond any doubt a success and an immeasurable asset in conducting combat assault operations.

The smoke generator consists of a circular tube of small jets (arrow) fitted around the exhaust

# ALL BUT FOUR

**Thirty-three people were involved in the raging storm that night. The four that didn't make it were the only ones that didn't have to fly**

**Major Allan L. Smith**

THE AFTERNOON heat had been oppressive, but a rising evening wind, driven by an oncoming storm, was now giving relief to those at the base camp. It was 1745 hours and Air Troop Operations of the 11th Armored Cavalry Regiment was relatively quiet. The duty officer was relaxing after a long day in the cockpit. At the other end of the operations tent the long range reconnaissance patrol (LRRP) radio operator was being relieved for chow. As he left he thought about the LRRP team troops who by now would be eating C rations beneath the jungle canopy in enemy territory. He did not envy them.

At this same time, miles to the southwest toward the South China Sea, the monsoon was up. A storm which had begun that morning at sea was a long, ugly line of trouble, and it had reached the shore. The squalls blasted ashore southwest of Saigon and radar verified the PIREPS. A severe weather warning was teletyped to outlying airfields and major headquarters. Channels of communication were long and for some units the message slow to arrive.

At 1752 hours a small orange light on the front of the radio blinked on indicating that the LRRP team was attempting to communicate. The silence in the tent was sudden and complete. It was not time for a communications check and the patrol was on radio silence unless enemy contact was made.

The voice that crackled over the radio was small, almost a whisper, "Three Zero, this is Dart Five. We have movement all around us and are unable to proceed to our RON position, over."

"Roger Dart Five, this is Three Zero. Have you been compromised? Over."

"This is Five, roger, they seem to be looking for us, over."

"This is Three Zero, we are scrambling now, out."

All activity in operations was reflexive. The duty officer flipped on the alarm switch. As the alert siren began to wail the duty NCO notified higher headquarters of the situation and told them an emergency extraction was in progress.

Outside in the troop area personnel seemed to explode from the mess, billets and all areas. The troop operations officer jumped into the alert C&C (command and control) slick along with the LRRP platoon leader and a LRRP medic. The troop had pulled many LRRP patrols out of the fire and so far it was business as usual.

Out in the jungle it was a different story. The LRRP patrol leader was nervous. Although he had many LRRP missions under his belt, this was the first time he was in command of a patrol. At the moment his experience offered him little comfort.

The alert fire team was the first air element over the patrol and the team leader reported no contact with Charlie. The jungle canopy was heavy and the wind had become very noticeable. It was impossible to see anyone on the ground.

As the C&C ship neared the patrol with another lift ship, the patrol leader called again. Fear was unmistakable in the young NCO's voice.

The operations officer began to reassure the patrol leader, "The guns are on station, we have artillery and ground reaction forces on standby, and you have not received any ground fire. Take it easy and start walking in the direction it is easiest for you to move, over."

The patrol answered by saying it was surrounded and couldn't move at all.

C&C was calm and matter-of-fact, "Since you're surrounded you can move in any direction, so move on an azimuth of 095 degrees. There is an LZ in that direction about 300 meters from your position."

As the patrol finally began to move, reassured for the moment, the operations officer aboard the C&C looked anxiously at the clouds

ANNUAL
AWARD
Monthly Winner
CONTEST

# All But Four

rolling in from the west. They seemed a long distance away but stretched as far as the eye could see to the north and south. The ops officer advised the troop commander of the situation and that he probably would need relief on station. The CO replied that he was just preparing to depart base camp for the extraction site.

The gunships were very low over the patrol. Slightly above the guns the two slicks droned in orbit. A whisp of yellow smoke filtered through the foliage and quickly boiled away downwind as the patrol marked its position. It had moved only about 50 meters but was on course to the LZ.

The sky began to darken and in the high winds the guns had difficulty staying accurately on station. As the CO arrived he asked the patrol to mark its position again. With darkness closing in the smoke was barely discernable, but revealed that the patrol was still about 150 meters from the LZ.

The patrol leader told the CO that he thought they were being followed and requested extraction from their present position. The CO decided there was no alternative and ordered the first ship in for an extraction.

As the first slick settled carefully into position above the thrashing treetops the gun team requested relief. The relieving fire team had just departed the base camp and the alert team rapidly briefed its leader as the two teams passed enroute. The relieved alert team arrived at the base camp as the first rain began to fall. *It was the last flight to get back unassisted.*

The long nylon ropes were

They clung tightly to the ropes as they cleared the trees and rain began to pelt their faces

dropped through the trees to the six men. Every foot of rope was used before the rigs reached the ground as the ship hovered 15 to 20 feet above the jungle roof. The extraction orders to the patrol were that only two men would be lifted by each ship and there would be three lifts.

The first two patrol members looked anxiously up in the darkness as they felt the tug of the liftship. They clung tightly to the ropes as they cleared the trees and rain began to pelt their faces. They were quickly taken to a nearby fire support base and gently set down.

Already the second liftship was over the patrol and began to lower the ropes. Once again the orders were sent to the patrol, only two men on this lift also.

The crews were now operating in almost total darkness. The tension was high, both in the air and on the ground. To the patrol members the minute or two that elapsed between the first and second liftships seemed an eternity. The wind and rain were so loud that a helicopter could be heard only when hovering directly overhead. The four men began to sense a feeling of total isolation. When the rope slowly settled down to them all four hooked up. They gave the signal to go.

Meanwhile the winds had reached 20 knots, gusting to 40. The hovering helicopter slowly began to rise. The load came up about 10 feet when the ship began to roll into the load. There was no communication possible with the soldiers dangling below.

The cyclic control was nearing its lateral stop as the aircraft commander attempted to level the helicopter. Then the ship began to settle sideways into the trees as the low rpm audio and warning light came on. There was nothing to do but jettison the load!

The crewchief started to cut the rope. Suddenly, the ship was lifted

## All But Four

on a high gust of wind and appeared to leap into the air, clearing the trees with its load.

The CO ordered all aircraft to return to base camp and stand by. He next directed the extraction ship to take the troops to the fire support base. The first liftship, on its way back from dropping off its load, turned toward the base camp and reported going into clouds, then went silent.

At this moment the relief gun team leader was heard to tell his wing man to execute an immediate 180-degree turn and return to base camp. The gun leader informed the CO that he had also inadvertently gone into instrument flight conditions and was attempting to make a 180-degree turn to VFR conditions. The CO advised him to report when VFR or if he encountered any further difficulty.

Back at the base camp, the troop maintenance officer had been orbiting over the runway while he monitored the progress of the extraction on the radio. He gave the lone wing man an FM steer and the gunship managed to find the camp. The CO also requested an FM steer, but gusty winds made accurate navigation difficult. Providentially, the storm subsided for a few seconds and the maintenance officer saw a helicopter passing to the east of base camp on a southerly heading. The CO was told to turn to a heading of 270 degrees. In a few minutes he arrived over the runway. *Two down and three to go.*

The extraction ship reported that he was safely down in the fire support base, but two of the patrol members were injured and two others had fallen off into the trees. The slick was ordered to remain in the fire base until the weather cleared. *Three down and two to go.*

The lost gunship had turned toward a nearby Vietnamese town in which a Military Assistance Command, Vietnam (MACV) airfield was located. When the ship failed to fly into clear air, the aircraft commander climbed to 4,500 feet for terrain clearance and continued toward the town. The aircraft commander began to experience the first uneasy symptoms of spatial disorientation. The fact that his altitude indicator was 15 degrees off in the roll attitude was not helping matters. Just as his aircraft control began to get erratic he saw the clouds open up and down below in the rain the crew could see lights.

The transient elected to depart despite the severe weather warning

He orbited the lights a few times to confirm his position over the MACV installation. Then he spiraled down through the hole. The spiral with its high rate of turn and unusual attitude began to effect both pilots. The only reference outside the aircraft was the fading lights which appeared at a crazy angle out the right door.

In this confused condition the clouds swallowed them up again. The aircraft commander had directed the copilot to take the controls as the spiral began for fear that if the aircraft did enter the clouds again he would lose control completely. Somehow the copilot got the ship level and climbing. The crew decided to get help and turned for an Air Force base to the west. That was where the nearest GCA was located.

At the base camp the maintenance officer was still airborne as he vainly tried to contact the two lost ships. Suddenly, to his amazement, he heard a transient maintenance ship call the base camp tower for takeoff. The maintenance officer advised the transient that the winds were gusting from 20 to 40 knots, the visibility was less than ½ mile and the ceiling was obscured with heavy rains in all quadrants.

The transient reaffirmed his decision to depart and remarked that he only had a 15-minute flight to his home base to the west. Once again the airborne maintenance officer asked the transient to reconsider and added that there already were two ships lost in the heavy rain clouds.

The transient replied, "Thanks for the information, but I think I can make it."

There were four people onboard the transient as it departed to the west. Immediately the rain and clouds seemed to snuff out the departing aircraft's navigation lights.

The gunship heading for the Air Force base GCA had been flying for 20 minutes at 6,000 feet and was still in the clouds. The aircraft commander had been trying to contact the air base on all possible frequencies including guard. He finally managed to get the Army heliport adjacent to the air base and was told GCA was standing by on its primary frequency. For another five minutes he attempted to contact GCA to no avail. He switched back to the heliport frequency and was just about to call again when the ship broke out of the clouds into a very large hole. Almost directly below was a base camp.

The crew decided the camp was the division base to the west and began a rapid descent. The aircraft commander advised the heliport at the airbase that he was landing at the division camp. While descending, he was reminded of the earlier aborted descent. This time the lights stayed in sight and as the aircraft was rolled out on final approach he could not believe his eyes—he was landing at his own base camp! He had flown 25 minutes on a westerly heading and had gone three miles to the west and eight miles south. *Four down and one to go.*

Troop operations was still trying to contact the lost slick. The D model had been flying for two hours and fuel was getting critical.

The slick, at that moment, also had been flying west for some time. The pilot was having little difficulty with aircraft control at 7,000 feet, but had no idea of his position. When the indicated fuel remaining reached 300 pounds the aircraft commander began to transmit a distress call on guard to Paris radar control. Paris finally heard the ship, but could not locate it. Paris then advised that the weather seemed to be improving on the coast.

The pilot turned south in a last attempt to reach clear air. Radar began to concentrate its search to the south and east. A weak target was located on a bearing of 130 degrees at a range of 48 miles. *That couldn't be the chopper out to sea?*

In desperation the radar operator called the ship, "I have a possible target 48 miles to the southeast. For radar identification turn right to 330 degrees."

Slowly but surely the target turned to the assigned heading then faded off the scope.

Paris quickly advised the ship that radar contact was lost, but to maintain a heading of 330 degrees.

The pilot replied that he was leaving 7,000 feet in a final descent with 160 pounds of fuel indicated.

Paris control could do nothing more but advise air sea rescue of the ship's last known position and heading.

As the slick descended the copilot stared into the red and green curtain of cloud in front of the windshield. Suddenly the red and green glare vanished and below he saw snow! No, not snow, but white caps. The shock passed instantly as he saw the white line of surf pounding the beach just ahead. A last call was made to Paris to report that they were landing on a beach. There was no reply. As the ship settled onto the sand more rain obscured a dim light in the distance. The engine was shut down with two hours and 35 minutes flight time and 60 pounds of fuel indicated. The wait began.

A few hundred meters away a young ARVN MP walking a guard post in his company's bivouac position heard the unmistakable beat of helicopter blades. He peered toward the beach where the sound seemed to originate. The sounds had been low as if a helicopter had landed, but now he could hear nothing except the wind and surf. He did not think a chopper would be out in such weather. Still, his orders were to report anything unusual, so he sent word to his cap-

tain that a helicopter may have landed on the beach. The captain quickly aroused his American counterpart and with a few men they headed for the beach.

On the beach the crewmen had posted security and their immense sense of relief over a safe landing was slowly replaced with anxiety over the security of their position. The rain subsided again and the light in the distance began to wink again. White, dark, white, dark again green. It had to be an airfield.

The aircraft commander crawled into the ship and called the tower at the only airfield he could think of in such proximity to the beach. The tower immediately replied and the downed ship gave the magnetic bearing from them to the rotating beacon light and requested fuel. A CH-47 Chinook, already alerted to the downed aircraft, was soon on its way.

As the aircraft commander turned his radio off he heard the booming voice of his crewchief posted on flank security, "Halt, who goes there?"

A cheerful American accent replied, "Hey man, we're friendly policemen out looking for you guys. Need any help?"

Gratefully the crew greeted the smiling Vietnamese MP patrol and the U. S. advisor. The MPs set up a perimeter and soon the Chinook arrived with the needed fuel.

In air troop operations a message arrived from air sea rescue, "We have located the lost aircraft and it is now landing safely (at the coastal field) with all hands." *Five down.*

Just then the telephone rang. It was the CO of a unit to the west asking about his maintenance ship and its crew. He was informed of the transient's hasty departure hours earlier in the storm. The CO asked air troop operations to assist in a search the following morning, but the troop was able to provide very little assistance because it still had a search of its own to conduct.

The two missing LRRP patrol members were found the next day after an extensive air and ground search. The patrol leader, was slightly injured but both had survived the wild ride through the trees and a full day alone in an unsecure area.

Dame Fortune had smiled.

## Epilogue

There were many factors, errors and circumstances woven into the fabric of this stormy saga. Many potential accident cause factors appeared but did not cause an accident. Each circumstance or event seemed to trigger another and another. Yet without explanation disastrous circumstances evolved into good fortune.

The lost gun leader did not execute a 180-degree turn into known VFR conditions, but rather he turned onto a vague heading toward a familiar town. The town was a few kilometers from a 3,000-foot mountain and the MACV airfield was studded with tall radio antennas. Yet, he made it to the town and somehow the clouds opened up for him to see it. He hesitated too long and lost that chance. Fortunately he got another later.

The lost slick wandered about far too long trying to locate itself before calling for help. The aircraft had a working AN/APX-44 transponder, but it was never used. The Decca system was also working, but the crew had not used it often enough to be familiar with it. The red deccometer was written up as inoperative so the crew decided the system didn't work and failed to set it up on takeoff. The aircraft was lost and the crew did not use everything available to locate themselves. Luckily they found the beach in time.

None of the aviators involved that night had standard instrument ratings in rotary wing aircraft, but each was able to maintain control of the aircraft under very difficult instrument conditions. Undoubtably the rotary wing tactical instrument program saved the two lost crews.

The big unknown factor that night which played so large a part in the nightmare was the wind velocity. At 6,000 feet the winds were 80 knots from the west-northwest at the height of the storm.

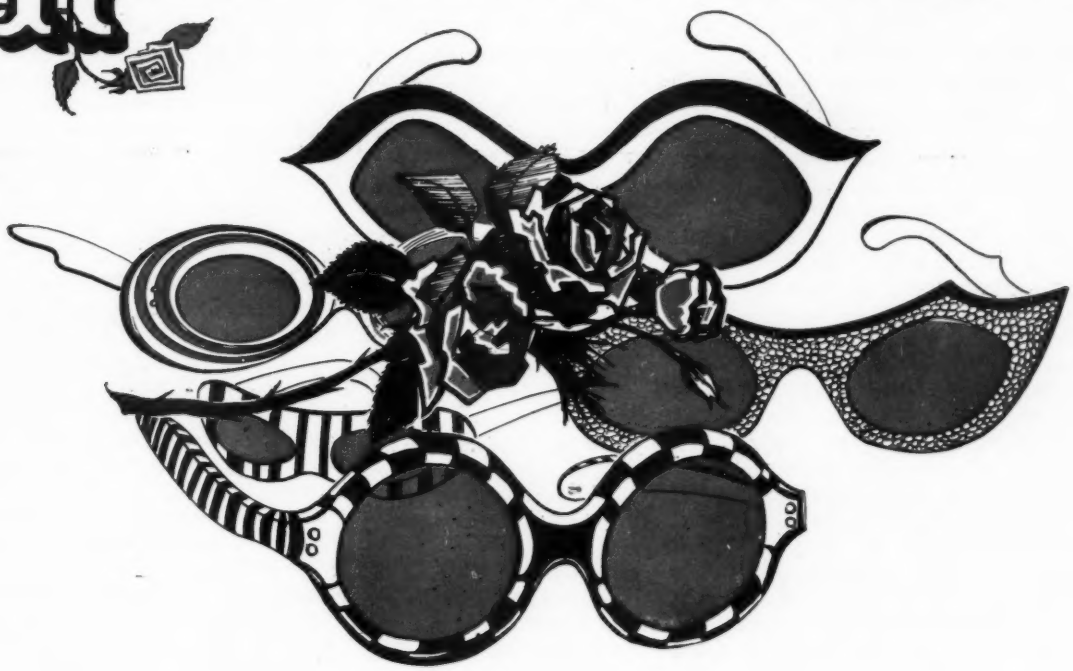
The entire mission was launched because a young patrol leader allowed his nerves to override his judgment. There never was any solid evidence of enemy presence even during an extensive ground search of the extraction site that night and the next day.

As for the missing transient helicopter, it was found five weeks almost to the day, after the night of the storm when a friendly intelligence-agent reported a crashed helicopter to the south of the base camp. A ground patrol found the aircraft with its crew still in their seats.

Of the 33 personnel involved in the storm that night 29 made it home. All of these 29 individuals were involved in a mission of urgency—as far as could be determined at the time. Four of the people decided to fly just to get home.

They never made it.

# ROSE COLORED GLASSES?



**Our eyesight is invaluable to us and can mean the difference between life and death. But we readily obscure this valuable sight—perhaps because of ignorance—perhaps because of thoughtlessness**

**Major Nicholas E. Barreca**

ONE OF THE MOST valuable senses possessed by an aviator is that of vision. The Army goes to great lengths to insure the selection of excellent visual capabilities in aviation applicants and continues to maintain strict visual standards throughout an aviator's career. It stands to reason then, an aviator should do all in his power to protect and insure the optimal functioning of the invaluable and extraordinary visual apparatus he possesses. Seeing the world through "rose colored glasses" may enhance its appearance, but it diminishes sensitivity and provides a rather narrow and superficial view. Knowing this, why do we so readily obscure this valuable sight, when it can mean the difference between life and death? Perhaps because of ignorance; more likely, because of thoughtlessness.

# Rose Colored Glasses

Why all this banter about sight? Well, probably because 50 percent or more of you are disabling your vision by improperly "enhancing" its powers. How are you doing this? Gather round and "see"!

Cigarette smokers are the biggest offenders, particularly those who inhale. Contrary to any folklore that may exist, smoking does not sharpen your eyesight. First, smoke is irritating to the mucous coverings of the eye. As a result, the eyes tear and blink, obscuring your vision. Second, and most important, the constituents of cigarette smoke include carbon monoxide and arsenic, as well as the highly publicized nicotine and cancer producing tars. Carbon monoxide interferes with our visual ability to produce the necessary conditions for night vision. Any individual who smokes 20 to 30 cigarettes per day or three cigrettes in close succession will saturate his blood with 8 to 10 percent carbon monoxide.

"So what?" you say. Well, this is like being at 9 to 10,000 feet altitude, without having left the ground at sea level. This has been proven to significantly decrease your night vision, in addition to the decrease due to the effects of relative hypoxia (decreased oxygen concentration as a result of thinning of the atmosphere with increasing altitude). As a smoker, your night vision is reduced by 20 percent between sea level and 4,000 feet. At 6,000 feet the reduction in night vision is 25 percent as compared to 5 percent in non-smokers. At 10,000 feet a reduction of 40 percent exists as opposed to 20 percent in non-smokers. It's hard enough to see at night and at altitude without further incapacitating yourself. If you must smoke, why not cut down to one-half pack per day or less but none within 6 to 8 hours before a night flight. Try nonfattening, low-calorie suckers or the microphone mouthpiece to satisfy any oral needs.

Pipe and cigar smokers are less apt to affect their night vision, since they usually do not inhale nor do they smoke as frequently. But only the most foolhearty of those among us think they can control an aircraft in a tight situation, while simultaneously struggling with pipe paraphernalia or a clumsy, smoke billowing cigar.

Now let's head upwind a bit (to get the smoke out of our eyes) and take a look at another potential visual hazard. Being basically credulous and trusting of our fellow man, we fall easy prey to some of the Madison Avenue-type advertising tactics frequently displayed commercially. Some recent developments bring our attention to sunglasses; orange and yellow as well as variable-light transmission sunglasses. Most certainly, the Army authorizes, by regulation, the use of sunglasses by aviators. We like to have something to do with the choice of glasses, though. The use of properly constructed sunglasses, particularly on bright, sunlit, clear days, to combat glare and to spare the rods for your night vision is highly recommended. Exposure to high intensity, continuous, bright light does decrease your dark adaptation ability, as well as interfere with daylight vision, so we advocate the use of sunglasses to combat these problems. The Army purchases fine quality filters that reduce glare and intense light stimulation, but within certain limits. Acceptable glasses transmit more than enough light for you to see that obscure landing strip or that other aircraft coming toward you. The N-15 sunglasses you possess are neutral density filters, not polarizers. They transmit roughly 15 percent of the light incident upon them. In addition, they transmit all colors more or less equally well. Thus, you can discriminate colors while using them.

Specifically, we warn against the purchase, for use while flying, of yellow or orange (or any other color) sunglasses described as so-called tinted night driving glasses. These glasses have been falsely advertised to eliminate glare, enable one to see in the dark or through fog glare, allow all the light to reach the eyes and improve night vision. These glasses introduce the danger of further reducing the light available to the eyes under already dim conditions. In addition, they obscure the discrimination of colors. The Federal Trade Commission has already issued a warning concerning glasses with the above claims.

It is true that the U. S. Air Force has found both subjective and objective evidence to show that yellow lenses do enhance a pilot's ability to distinguish defoliated terrain from normal terrain. For this reason they have authorized use of these glasses for pilots flying defoliation missions. On the other hand, specific investigations have not demonstrated any improvement in visual detection of ground targets under haze conditions. No other scientifically controlled study has demonstrated any advantage other than described above. A good deal of prejudice surrounds the use of these glasses, particularly when dealing with marksmen or skeet enthusiasts. Be it sufficient to say that yellow lenses are useful under very specific situations, they are not recommended for use in the general aviation environment. The sensitivity of the retina (the light sensitive layer of the eye) is quite different from photographic film. Just because yellow filters are used in photography does not mean they are suitable for vision.

The second type sunglasses to avoid are those advertised to automatically or mechanically vary the darkness of the lenses. These glasses, when recently evaluated, were found to be unacceptable for general use. Sunglasses are best if they transmit at least 10 to 15 percent of visible light. The variable darkness glasses, under most conditions, transmit far below 10 percent of the available light. Again, rather a dim situation.

These glasses, in addition to many other glasses available commercially, are optically impure. Many have high degrees of color distortion as well as excessive prism (due to improper curvature) to further interfere with vision. So again the warning: Seek those glasses which have been specifically designed to contain the necessary properties for optimal optical performance, particularly the glasses purchased to meet military specifications. Remember also, the post exchange is not required to offer sunglasses exclusively acceptable to aviators. Accept our standard, not so flashy, wire-rimmed issue sunglasses with a smile of confidence. They are for your protection and definitely should be used for the purpose intended.

Incidentally, the sunglass visor provided with your helmet serves a dual purpose. In addition to sunlight protection, it is utilized to decrease the surface area of skin and valuable visual apparatus exposed to possible flash fires or missile and plexiglass fragmentation which may occur during emergency or crash landings and combat situations. It can be most effectively used during takeoffs and landings. Use common sense, though. If visibility is already restricted, don't restrict it further with a sun visor and end up causing an accident. The clear visor used in conjunction with sunglasses is a better choice, for it can provide protection alternatives for day and night flying.

Glasses don't have to be colored or tinted to create disconcerting problems. Individuals wearing corrective lenses for distant vision may paradoxically be at a slight disadvantage while flying at night. The corrective lenses, unless specially treated, only transmit 92 percent of incident light. Antireflective coatings can be applied, increasing transmission to 98 percent. Such treatment of lenses provides us with "night flying glasses." These glasses do not enhance night vision magically, they are simply an improvement over wearing plain glasses, for individuals requiring corrective lenses.

Some pilots, not wishing to admit their failing vision, will find the "rose colored glasses" are their own eyes. Under night circumstances, all of us become relatively near-sighted due to a shift in the nature of visible light to the blue side. Pilots who are already slightly near-sighted will become more so at night. Images under these conditions may become indistinct; vision may be obscured. Aging pilots (those over 30, sorry fellas), particularly if far-sighted, may have difficulty with the red-lighted cockpits. We are all slightly far-sighted for red light. If far-sighted under daylight conditions, those of us with weak accommodation (a not uncommon companion with age) will not be able to compensate for this red-lighted far-sightedness. Thus, vision will be blurred.

Each of these conditions can be corrected by your friendly flight surgeon, if you put aside pride and "ungrounded" fear. He can prescribe special night flying corrective lenses for each specific condition. These are usually minor problems that do not raise questions of your suitability for flying. Don't hesitate to bring them to medical attention.

Finally, remember what Captain Finkleding-a-ling (cleaning his pipe, while peering quizzically through the moonlighted mist with his variable purple people peekers), said to Major Frozzleforth (who was puffing billows of smoke from his 55th cigarette), "Is that a radio tower I see before us?" Major Frozzleforth answered, "I don't hear anything."

# WHAT IS PWD?

**Charlie Martin**

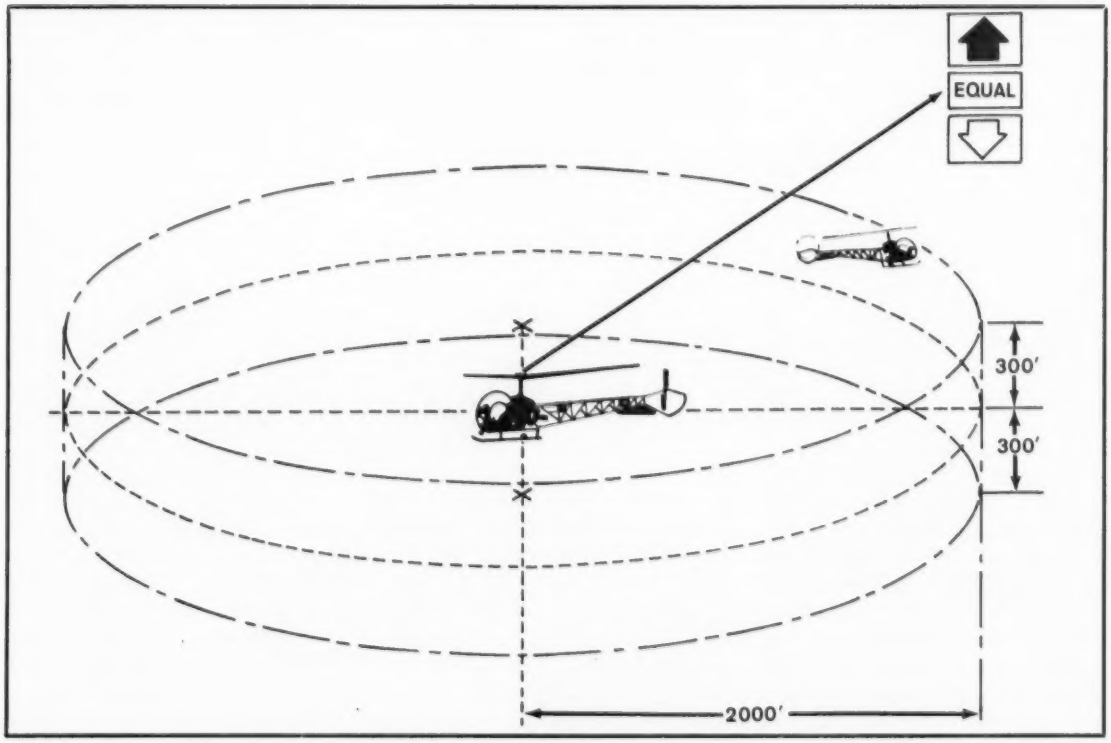
ANOTHER JUMBLE of letters in the overcrowded jungle of acronyms? Perhaps, but those of us who have had an opportunity to see the Proximity Warning Device (PWD) in action and to test it don't think it will be difficult to remember.

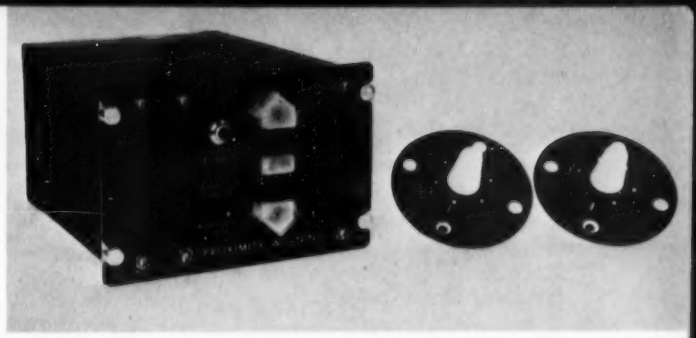
The PWD has been developed as an aid in the prevention of midair collisions, and as an aid it may not provide everything we'd like, such as range and azimuth, but it does warn of another aircraft in close proximity and gives the aircrews time to avoid a possible collision.

Few of us are aware of the tragic toll in life and property of midair collisions. During the 24 months from November 1966 to November 1968, seven midair collisions in the Ft. Rucker, Ala., area took 24 lives, 13 aircraft were destroyed and the materiel loss was approximately 2½ million dollars.

Everything possible has been done to insure adequate separation of training aircraft. The plans for training areas, air routes and alti-

Below, a typical application of the Proximity Warning Device. The helicopter at the center of the protective envelope would be warned that an "intruder" is nearby and above. At the same time the aircraft at the right would be cautioned that an aircraft representing a potential collision hazard was below. The intruder's position is indicated by one of three lights on the display panel (above)





Left, TH-13T helicopter installation of the Proximity Warning Device with the panel display mounted on the center console. Right, the heart of the system includes the receiver-transmitter on the left and two dipole antennas which give omni-directional range coverage

tude separation are thorough and complete, but there will always be the ever-present potential of human error. Someone doesn't get the word, misunderstands instructions, becomes pre-occupied with the job at hand or simply becomes complacent. These are the things that the PWD is designed to overcome.

Personnel of the U. S. Army Aviation Center have been actively working on the development of the PWD since 1967. They enlisted the aid of the U. S. Army Board for Aviation Accident Research, the U. S. Army Electronics Command and the U. S. Army Aviation Test Board. The combined efforts of these organizations have resulted in the development, testing and selection of a Proximity Warning Device for use in the training environment.

The initial devices are tailored for use in the TH-13T helicopters, but will be readily adaptable to other aircraft. Studies (which later proved to be valid) indicated that the device should provide a visual indication and an aural warning when another aircraft approached within 2,000 feet horizontally and 300 feet vertically. The visual indication was required to show whether the approaching aircraft was at an equal, higher or lower altitude.

The technical requirements established by the Electronics Command for a PWD that would produce the desired warnings were considered to be within the existing state-of-the-art and would not require extensive development, even though this was to be an entirely new device.

The PWD is a cooperative system. That is, each aircraft must be equipped with its own device because, as the developing engineers put it, "the PWDs talk to each other." Each device contains a sealed barometric sensor, a receiver and transmitter. The barometric sensor determines the coding of the transmitted pulses and positions an acceptance gate to permit receiving responses from only those systems within the selected range. If the barometric sensors are within plus or minus 300 feet vertically and the pulses are received through the acceptance gate, a warning is generated. The altitude band is further subdivided to provide the required visual altitude indications of above, equal and below.

Testing of the PWD was a real challenge; this was a totally new device. There was no precedent for test or employment, and operational techniques were just ideas. Several manufacturers were submitting equipment and time was limited. The first two weeks was a learning as well as test period and, fortunately, the first PWD played as advertised and allowed us to learn as well as test. During these two weeks, I believe we literally flew at each other from every conceivable angle and from ground level to 4,000 feet MSL to check for hysteresis of the barometric sensors. We measured the warning range and time at a sufficient number of relative bearings, altitudes and rates of closure to insure that the area covered was, in fact, a cylinder approximately 2,000 feet in radius extending 300 feet above and below each helicopter. Also we wanted to be sure that there were no holes in the cylinder that an intruder might slip through.

The minimum times from initial warning to potential collision averaged seven to eight seconds for head-on approaches and autorotations toward a climbing helicopter. We convinced ourselves by aborting collision courses after receiving a warning that there was sufficient time to find and avoid an intruder.

As a final test the PWD equipped helicopters were assigned to the Department of Rotary Wing Training's Basic Instrument Training Division. Two PWDs were scheduled for routine training flights and one was flown by test personnel as a deliberate intruder. It didn't take long to get an indication of how this phase of testing would go. Most comments were favorable, along with some warranted constructive criticism.

The instructor pilots were quick to recognize the capabilities and limitations of the PWD. They used it effectively and are looking forward to the time that all the helicopters in the training environment are equipped with the PWD.

If all goes well, they won't have long to wait. Honeywell Aerospace Division of Minneapolis has been awarded a $775,711 contract for 222 warning devices for use in the TH-13T helicopters located at Ft. Rucker and Hunter Army Airfield. Options in the contract could result in the purchase of an additional 1,293 units for a total contract in excess of $4.5 million.

Installation of the initial order will begin in about a month and will be completed by late spring 1970.

# THE DEADLIEST ENEMY

# BOREDOM

**. . . might as well go down on the deck . . . I'm not doing any good up here. I'm bored to death!**

**Captain Charles C. McCloskey III**

THE O-1 Bird Dog is seen silhouetted against the clear midday sky of the Republic of Vietnam. The complete master of its environment, it passes effortlessly across mountain and jungle, river and rice paddy. It now quickly descends, lower and lower, until it barely skims the trees. After the aircraft passes out of sight for a few-seconds thick, black smoke is observed rising where it was last seen. The aircraft has crashed, killed both occupants and is totally destroyed. Why?

**Safety Officer:** The aircraft was flown at a low altitude, approximately 50 feet above the trees, a not uncommon technique for the O-1. The pilot's attention evidently was distracted, leading him into a situation from which he could not recover. No evidence of hostile fire against the aircraft could be found.

**Flight Surgeon:** The pilot was an experienced combat veteran. He had been in the company for 10 months, strictly as a pilot, and had accumulated over 900 combat hours in the O-1. He had flown 103 hours in the past 30 days. I had seen him three days before his accident and found he showed no signs of fatigue whatsoever. He had no complaints and stated he felt great and wanted to continue flying. Nevertheless I medically restricted him from flying for the following day, instructing him to get a good night's sleep and to relax the next day. He had eaten normally the day of the accident and had consumed no alcohol in the previous 24 hours. He had noted no emotional problems to either me or his fellow officers in the company. I believe there were no physiological or psychological factors present having a direct causal effect on the accident.

**Platoon Leader:** The pilot was one of the best in the platoon, if not the best. He had not had an accident since receiving his wings. He was very skilled at his job, consistently returning from his missions with a great amount of intelligence data and/or reports of numerous enemy killed and structures destroyed by air strikes or artillery he had called in. He was disappointed if he came back from a mission with nothing to report. He enjoyed doing his job and took great pride and satisfaction in doing it well. His only drawback, which I had counseled him on at least twice, was that he flew low level to excess. I explained to him the inherent dangers of flying at this low altitude and he agreed and stated that he would be more careful. I have no idea what could have happened to him.

**Maintenance Officer:** All parts of the aircraft were recovered even though heavily damaged by fire. The engine was examined and no indications were found of materiel failure. The control cables and surfaces were also free of materiel failure. It is felt that the aircraft was in normal operating condition upon impact.

**Investigating Officer:** All available evidence points to the fact that the aircraft crashed due to pilot error in putting himself in a position from which he could not recover.

The above comments are not uncommon in O-1 accidents. But the reason for the pilot's error has not been discovered nor explained. What and where is the reason which caused it to happen? Was it weather, the enemy, materiel, the mission, improper supervision, poor training or what? Who or what is the deadliest enemy of the O-1 pilot in Vietnam?

**Pilot:** Boy, it sure has been a nothing day so far. Spent those first two hours adjusting artillery. What a waste of time! Round and round in circles for 120 straight minutes—and only two registrations completed! This whole AO's been dull lately. And I thought this visual reconnaissance flight might be good. There's not a damn thing down there worth looking at, just rice and trees. Can't see anything from 1,500 feet anyway. And this observer I've got! How come I always get the new guys? He doesn't even know how to read a map, much less talk on the radio . . . hey, wait a minute. That next valley is where I saw those five NVA last week. I'll bet there's more there now. Might as well go down on the deck, I'm sure not doing any good up here. *I'm bored to death.*

And there it is, as plain as a normal takeoff. The deadliest enemy to defeat in flying the O-1 in combat is plain boredom. The first few months, duty as an O-1 pilot will not normally be dull, but after the newness has worn off, the boredom can very easily set in. There are times when low-level flight is warranted and justified, e.g., confirmation of ground sightings and evasive action. But the temptation is to fly low level when there is no rational or profitable reason for doing so. And the odds for surviving any kind of aircraft malfunction, enemy hit or abnormal occurrence in flight drop meteorically at low altitude.

So what is the best way to fight this often fatal human frailty?

First, a mature, professional attitude must be maintained toward mission accomplishment. Each pilot must understand that he cannot be successful or necessarily satisfied each and every time he flies a mission.

Secondly, boredom can be overcome by self-improvement. The pilots must learn new lessons and tactics from reference manuals, from articles and publications and from other pilots. He must improve his skill within sensible safety limits. He must not lower these limits to obtain success, for he then endangers his life and the lives of others.

Next, he can develop teamwork in the aircraft, so that the man in the back seat does contribute something to mission accomplishment. True, some observers are better than others, but with patience and perseverance an effective and successful team can become a reality. Perhaps not on this flight, nor this day, nor ever with the same pilot, but none the less an effective team some day in the future, working together professionally to accomplish the mission, scaling out the hazards of boredom.

And last, the pilot must keep in mind the responsibility he has to others—his wife, his family, friends and relatives, his fellow pilots, his unit, his country. He, as an individual, is of great importance to these people and groups of people. Does he have the right to unnecessarily risk lives to merely break his boredom? Even with an unsatisfied ego and a high degree of selflessness the answer is no.

So chalk up the above accident to pilot error, combat loss or what have you. Regardless, the underlying factor was boredom. It is not unusual among O-1 pilots, or all pilots for that matter, but it is a dangerous aerial trait which must be avoided. Save your boredom for that 17-hour flight home—and thus insure you do make the flight.

## Attack Helicopter Pilots

# *Atten*...HUT!

**Although the 2.75-inch rocket and the 40 mm grenade have had proximity fuzes for more than a year, very few units are using them effectively**

**Captain Milton J. Brokaw**

THE VALUE of the attack helicopter has been proven time after time in the Republic of Vietnam. As an experienced attack helicopter pilot, I want to speak to all the aviation and ground personnel who are interested in increasing the fire support these helicopters are capable of giving. All of us have been looking for methods to increase their effectiveness and, as a result, such things as new or improved tactics have evolved. Also, new aircraft have been designed with better performance characteristics.

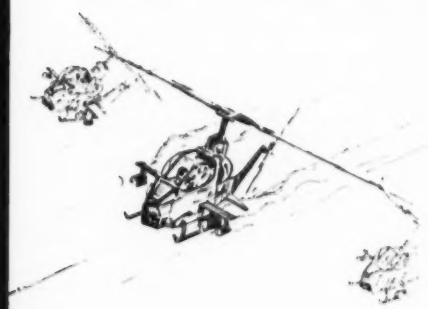
Emphasis on training attack helicopter pilots at Ft. Rucker, Ala., and Ft. Stewart, Ga., has increased to the point where these pilots are now learning as many of the fundamentals of attack helicopter employment as they possibly can in the time allotted. There remains one area where a significant increase in effectiveness is possible. This area is in the weapons themselves. Quite a few people have been concerned with this particular problem. As a result, tremendous breakthroughs have been accomplished. One such area concerns the fuze devices for the 2.75-inch rocket and the 40 mm grenade.

How many times have we all seen or heard about the "Charlie" with the "charmed life"? We have fired rockets and 40 mm grenades and have seen the impacts all around him only to find that when the smoke clears he was still run-

The proximity fuze can mean the end to the Viet Cong's seemingly charmed life. This closeup view demonstates how the 2.75-inch rocket can effectively "put smoke" on "Charlie"

ning, apparently unhurt. The same thing has occurred with the "Charlie" that you can clearly see snuggled down behind that dike but whom you just can't seem to hit.

Your immediate reaction is that these "darn" rounds are no good. The reason for this ineffectiveness is simple. In many types of terrain, especially soft or wet, the rounds with point detonating (PD) fuzes actually penetrate into the mud, water, ground, etc., before they explode. As a result, a large portion of the fragments and explosive power is contained underground and much of the rest directed upward and causes no damage whatsoever. What is the answer to this problem? The answer is the proximity fuze, which will get those lethal fragments down behind that log or dike or down into that foxhole. This will end the days of the "charmed life Charlie."



It has long been known that by placing a properly designed proximity fuze on a high explosive warhead you can increase the lethal area anywhere from three to 10 times and even more in certain special cases. The problem has been to provide a reliable proximity fuze at a relatively low cost. Unfortunately, some of the older fuzes that have been stock-piled from World War II and Korea have not been able to withstand long-time storage, and their reliability is somewhat less than desirable. New developments in the state-of-the-art have changed this. Today's solid state components and circuitry allow us to build small, reliable, low cost proximity fuzes. The M429 proximity fuze for the 2.75-inch rocket is the first of these new fuzes to be issued. When understood and properly employed, this proximity fuze can literally multiply effective firepower.

Now I come to the very heart of the message. The M429 fuze has been in the field for about a year. Tremendous effort has been put forth in order to get this more effective weapon into the hands of the troops. However, it has become apparent that for various reasons there is some reluctance to use this item. The reasons stated range anywhere from "I can't get them" to "The terrain in my area isn't right for this weapon." When you show the reluctant ones that they are wrong on both counts, then they usually come up with the actual reason: "Well, to tell the truth, I don't really know much about these new proximity fuzes. The old PD fuzes still work, don't they? And, besides, I have heard STORIES that. . . ."

One such "story" was related by a pilot who swore that he had been hit by a fragment from a VT fuzed rocket which had exploded in front of his aircraft. It turned out that a proximity fuze for the 2.75-inch rocket hadn't even been produced at the time of the incident. After being informed of this, he readily admitted that he had just assumed it was a proximity fuze since it detonated in the air. The harm done by that story and other stories of a similar nature is tremendously difficult to overcome and seriously hampers the acceptance of a new, more effective item.

Let me now explain a little about the capabilities and characteristics of the M429 proximity fuze for the 2.75-inch rocket. In general it is easy to understand. If you don't worry about the engineering details, the M429 is simply a radio transmitter and receiver. It bounces radio signals off the target and measures how strong the return signal is; and, when the signal is strong enough to indicate the presence of the target (at the desired height of burst), it detonates the warhead. It carries its own battery for electric power and a safety and arming device. The safety device assures you that unless the round is properly launched and travels a safe distance, the fuze will dud.

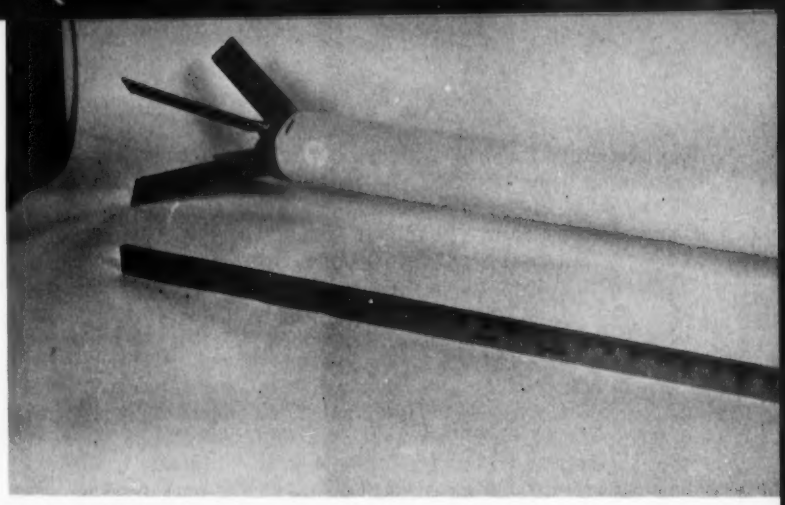
This safety and arming (S&A) device is a standard requirement for all fuzes including the point detonating type. In addition, there is an impact element included in the M429 so that if the radio portion fails, the round will still function when it strikes the ground. All of the above parts must work together in the proper sequence. When the fuze is attached to a rocket and fired, it must turn itself on, warm up in a fraction of a second and perform flawlessly under extreme conditions of temperature and humidity. Even before this, it has to survive shipping around the world by rail, ship and airdrop. In addition to being just plain safe and rugged, it must have special circuits that make it smart enough to see the ground but not the round in front or in back or the rocket traveling alongside, and it must not

be confused by local radio or radar transmissions. Although some individual parts of the fuze are delicate, the overall fuze is designed to withstand some pretty rough treatment.

Although both the M429 proximity fuze and the M423 PD fuze are rugged and reliable, neither is perfect. In this imperfection there lies a major misunderstanding about the proximity fuze as well as an unreasoning reluctance to use them. When a regular PD fails, the projectile is a dud. With a proximity fuze some of the failures are duds and some are "earlies." An early is defined as a detonation prior to reaching the target. With the M429, the rate of earlies is actually less than 1 percent, which is the lowest early rate of any comparable fuze. What is really hard to grasp is the "earlies," although startling, are not necessarily dangerous.

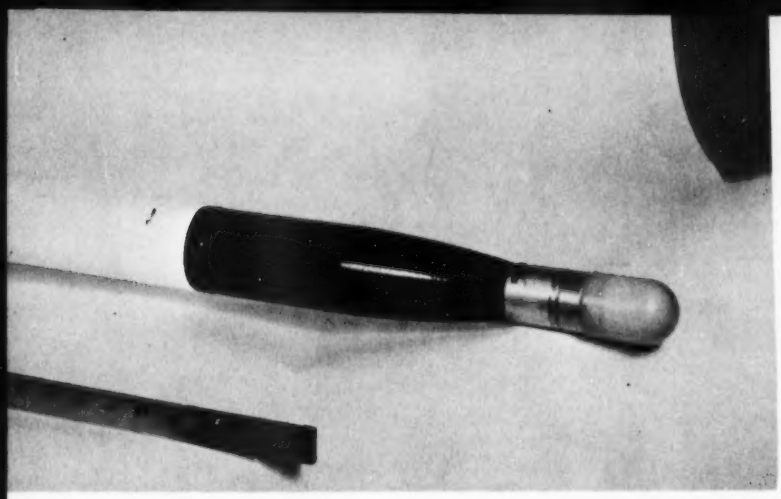
Earlies are new and frightening to most attack helicopter crews because they think that the round is capable of exploding close enough to be dangerous. Such is not the case. The safety mechanism of the M429 has been designed to insure that the round must travel a safe distance from the aircraft before it can physically detonate. As a matter of fact, the safe distance was extended a considerable amount in the M429 as compared to the M423 PD fuze just to give an additional safety margin. Extensive tests by the Test and Evaluation Command have shown that M429 fuzed rockets are completely safe with respect to the crew that fires them.

Now let's discuss the troops on the ground and the effect of an early function along the flight path of the round. We can break this flight path into two parts. First is the mid-range portion which is normally a considerable distance from the ground, and second is the terminal phase as the projectile approaches the ground. Consider first the mid-range portion. A detonation here will normally cause no more damage than any other object, such as falling brass from machineguns, etc. The reason is that these small fragments have a very high drag through the air and very soon lose velocity to the point where they become very small free-falling objects. In most cases, small free-falling objects do not have enough momentum to penetrate the skin. At worst, a person might receive a small scratch from one of these particles. As an example, contact one of your friends who does bird hunting with a shotgun and ask him what it is like to have shot raining down on him when someone else is firing close by. He will probably answer "irritating but most certainly not harmful." Physically speaking there is little chance



The 2.75-inch folding fin rocket

Before putting proximity fuze to use

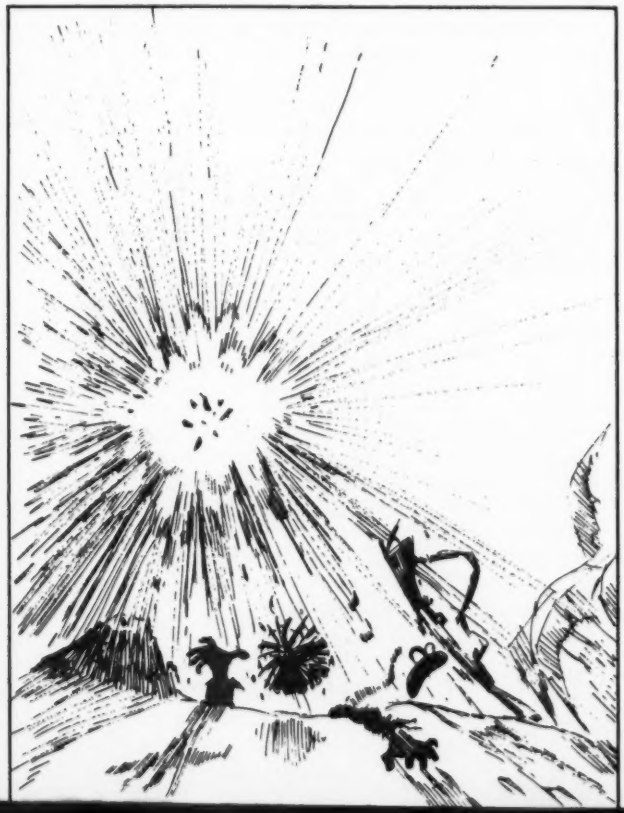


with the proximity fuze

of harm; however, psychologically speaking, there may be some concern until personnel understand that these detonations are relatively harmless.

The last portion or the terminal phase of the flight path is a different matter. Here the round begins to act as it was designed to act. However, you would normally assume that the terminal phase is within the general target area. If firing in close support of ground troops is necessary, then use of the normal prescribed procedures of flying parallel to friendly troops, steeper angles of approach, etc., should be considered. These normal tactics are employed in close support, not so much because of the devastating effect of the warhead, but because of the inherent inaccuracies of the delivery system, mainly the rocket itself.

After



What is the safe distance then? Let me first remind you that the published minimum arming distance for the M429 proximity fuze is 500 feet[1] which was designed to provide maximum safety to the firing crew. A further study of the data available indicates that the probability of a casualty from an "early" decreases rapidly as you increase the distance from the point of burst. At a lateral distance of several hundred feet from the point of burst, the probability approaches zero. (For more details see reference in footnote 2.)

Then why is a proximity fuze more lethal if it doesn't significantly increase the distance or bursting radius of the round? Simply because it lifts the burst up off the ground and allows all those particles that would have been buried to act on the target area. As I said before, this increase in lethality is in the neighborhood of three to 10 times and in some cases even more. I think we would certainly call that a significant increase.

In summary, it should be emphasized that the M429 is a safe, rugged, reliable item which has shown and will continue to show a tremendous increase in effectiveness of the attack helicopter concept. Every man in the Army is vitally concerned with accomplishing the mission and increasing effectiveness anywhere he can. The M429 proximity fuze is a giant step in the right direction. Other steps are also being taken. One is a proximity fuze for the 40 mm grenade used in the aircraft weapons system. It will be in production soon and in the hands of the troops shortly thereafter. It is items like these that will end the days of the "charmed life Charlie" forever!

1 TM 9-1340-201, "2.75-Inch Folding Fin Aerial Rocket," 15 July 1968, p. 2-11.

2 Joint Munitions Effectiveness Manual (Air To Surface), "Safe Distances for Friendly Troops" (CONFIDENTIAL), TH61A1-4-5, 18 Nov 68.

# Charlie and Danny's Write-in

Dear Danny: Something is missing from the UH-1D/H dash 10 that a lot of us wrench twisters liked—that is the instructions for computing the information that is entered on the GO-NO-GO takeoff data placard. Huey maintenance personnel hereabouts are having to refer to a November 1967 manual for instructions. Can we get that information back in the manual?

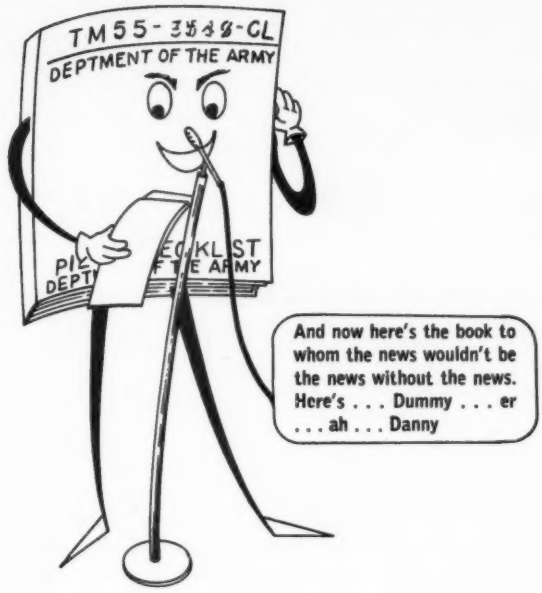
**Danny's answer: The dash 10 was changed to give the pilot instructions on how to use the information you and your "wrench twisting" buddies put on the GO-NO-GO placard. Instructions on how to compute the GO-NO-GO data is located in the Organizational Maintenance Manual (dash 20).**

Dear Charlie: Why is the red line at 3200 rpm on the TH-13T engine tachometer? The way I read the dash 10, rpm is not limited to 3200. Which am I to believe?

**Danny's answer: Charlie says I should do the work on this one so here goes. The red line is in the correct place on the tachometer and indicates maximum continuous rpm (3200). For limited periods (not to exceed 5 minutes), if you allow the rpm to go above 3200 the engine will not be damaged, provided 3300 rpm is not exceeded. From 3300 + 3400 rpm for any duration or 3200 — 3300 rpm for over 5 minutes requires an entry in DA Form 2408-13. From 3400 to 3500 rpm for any duration an inspection is required. Above 3500 rpm the engine must be removed. In any case, engine operation above 3200 should be limited to the *shortest time possible.* Any time 3300 rpm is exceeded the amount and duration must be recorded on DA Form 2408-13.**

Dear Charlie: A lot of us here at Ft. Leavenworth are flying T-41s and have a hard time finding checklists. In fact, I've never seen a Department of the Army checklist for the T-41. Is there such a publication?

**Charlie's answer: Some aircraft such as the T-41 and T-42 were procured as "off-the-shelf" trainers. Manufacturers' handbooks are the only publications available and Department of the Army CLs are not published for these aircraft. A request has been submitted for a change to this policy thereby allowing publication of dash 10s and dash CLs for all Army aircraft.**


TM55-3548-CL
DEPTMENT OF THE ARMY
And now here's the book to whom the news wouldn't be the news without the news. Here's . . . Dummy . . . er . . . ah . . . Danny

Dear Charlie: I feel that it is time to design and distribute a dash 10 CL which can and will be used by the individual aviators in the field. Right now we are required to use the dash CL as issued in (1) loose-leaf form, (2) stapled together or (3) stuffed in the TM 1500-1 binder which is too large, too cumbersome, too expensive, too hard to get and often ignored in the form of a locally produced checklist. Why shouldn't field units develop their own CLs; USAAVNS has its own version. A firm stand behind a practical product has long been necessary in Army aviation.

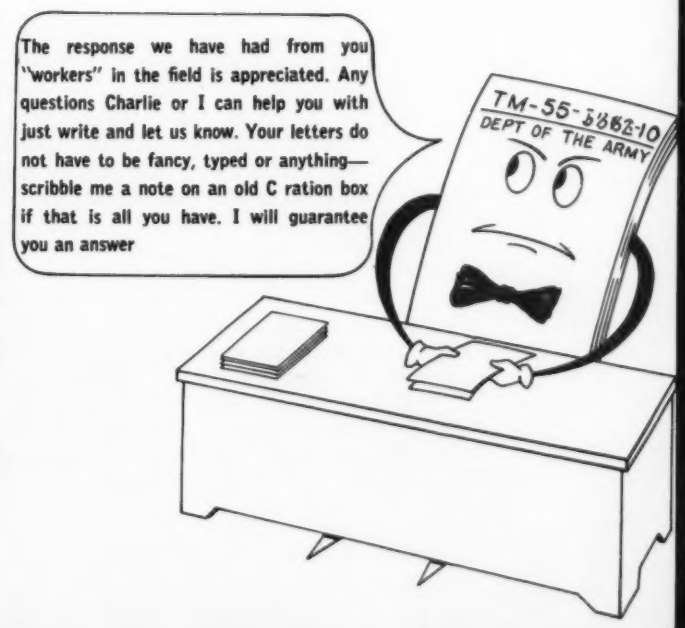
**Charlie's answer: The checklists that you refer to have been designed and are distributed as they become available. The TM 1500-1 has been proven to be extremely effective as a container for the CL in all aircraft except the AH-1G, O-1 and the OV-1 and we are currently working on a modification of the binder for use in these aircraft. We had devised a CL which can be used by any field unit, regardless of its location, and which will provide standardization of procedures Army wide. USAAVNS does not, and I repeat does not, have its own version of the CLs. The school uses the approved DA checklists (except for off-the-shelf trainers) and has taken a firm stand behind these practical products. Why not join us in our stand?**

Dear Charlie: Investigation of a recent U-8D accident revealed that takeoff distance data was not available to the pilots for the most common takeoff condition of 20 degree flap. While it is realized that providing data for all takeoff conditions would not be reasonable, data for a minimum run takeoff (i.e., 20 degree flap) would be more useful than the zero degree flap data which is rarely used. Can this information be added to the dash CL and dash 10 in the next revisions?

**Charlie's answer: A performance data chart for the 20 degree flap minimum run takeoff was not compiled for the U-8D on initial procurement. Since your request steps have been taken to obtain this information for publication in the dash 10 and CL. Look for it in future changes to these publications. The U-8D has been around for a long time and this is the first request I have had for this data. Makes me wonder if performance data charts are used before takeoff or if they are reserved for the accident investigations.**

Dear Danny: We just got our new OH-58s and the new manuals that go along with them. We've noticed a few items in the operators manual that seem to be in error. The one that drew the most comments is on page 4-4, figure 4-2, normal approach and landing, power OFF. Step 6 says, "5 feet altitude, transition to forward flight." That maneuver would be a bit difficult power off, wouldn't it?

**Danny's answer: Not just difficult — impossible. Thanks for looking at the manual so closely. That step has been changed to read, "Just prior to ground contact, increase collective pitch as necessary to cushion landing." The new manual containing this change is in distribution now.**


The response we have had from you "workers" in the field is appreciated. Any questions Charlie or I can help you with just write and let us know. Your letters do not have to be fancy, typed or anything— scribble me a note on an old C ration box if that is all you have. I will guarantee you an answer
TM-55-3882-10
DEPT OF THE ARMY

# TORQUE: The Whyfors and Howfors

**What every good mechanic should know about a much discussed, but often misunderstood, term . . . torque**

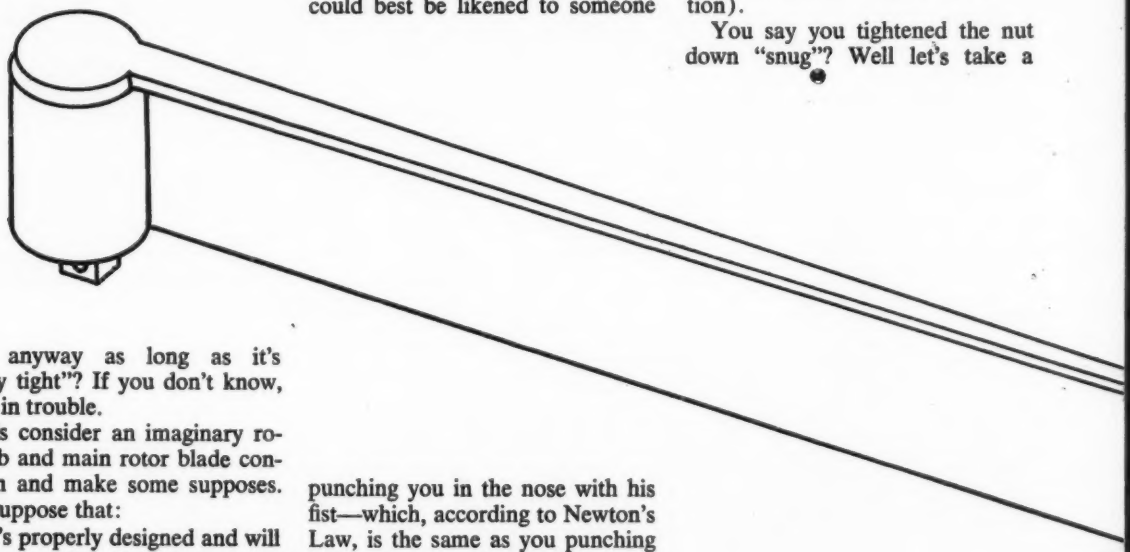
**Lieutenant Colonel Charles W. Sills**

WHY IS torquing correctly so important to property, life and limb? *Torque* this, *torque* that, too much *torque*, not enough *torque*—what difference does it make anyway as long as it's "plenty tight"? If you don't know, you're in trouble.

Let's consider an imaginary rotor hub and main rotor blade connection and make some supposes. Let's suppose that:

- It's properly designed and will work—also, that there's some way you can get into the contraption with a torque wrench.
- The nut and bolt are the correct ones for this particular rotor system.
- The nut has been tightened down till the joint between the rotor hub and main rotor blade fits snug.
- You didn't have a torque wrench and, in this case, not enough *torque* was applied.

What will happen to this rotor system under operating conditions can best be described by explaining Sir Isaac Newton's third law which states, "For every action there is an equal and opposite reaction." This could best be likened to someone punching you in the nose with his fist—which, according to Newton's Law, is the same as you punching him in the fist with your nose with the same force! No matter how much it hurts—that's torque.



Armed with this punchy explanation we can now make the following observations. If we start the blade rotating we know that centrifugal force will try to throw it off and in the direction of rotation—that's why we've got it bolted! The outward force on the blade is 10,000 pounds and, according to Isaac, there must be a force of 10,000 pounds in the opposite direction. The bolt has 10,000 pounds of pull on it (if you suspended the rotor hub from the ceiling and hung 10,000 pounds on the rotor blade, you would create the same situation).

You say you tightened the nut down "snug"? Well let's take a closer look at the rotor hub and main rotor blade and you will see that they have pulled apart some measurable amount. Know what happened? The bolt actually stretched—just like the ol' girdle. Every metal has a limit to which it can be stretched and still return to its original size. This is called the

*elastic limit*. Metal stretched beyond this limit is said to be in the *plastic range* and once the force that produced it is removed, the metal will never return to its original size (or length) but will remain permanently changed—and weaker! For example we will assume that the bolt stayed in the *plastic range*.

Let's suppose (again) that we can get our hands on a torque wrench in that main rotor blade cavity (while the blade is rotating!) and tighten down that nut till we pull the hub and blade back together so that they again fit snugly. Now, stop the rotor blade and let's see what's happened. First, we know the hub isn't trying to throw the rotor blades off because it's standing still. The 10,000-pound force of acceleration is gone but do you know what we've got?—10,000 pounds of torque on the bolt—squeezing for all it's worth. You can't see it, but that's torque. And what's more, it's 1,000 pounds more than we need in normal operating rpm so we have a little "gravy" in case of over-rev during a forced landing. Now are you beginning to see it? We've preloaded the bolt to 10,000 pounds and any time the rotor is turning at normal operating rpm (or less) there's really no *varying load* on the bolt. Even if we exceed redline we've still got that safety factor (gravy) built in because the mechanic torqued the nut correctly.

There's one more thing we should discuss which will be easier to explain now that you understand torque—it's just as bad to *under-torque* as *overtorque* because this gives you a loose joint (so to speak) and the rotor hub or nut or bolt or all three will fail from vibration and ultimate metal fatigue!

One word of warning about another "trap" we don't want to be led into—using too small a nut on the bolt. You can easily imagine how weak the connection would be if, for instance, we used a nut that was half a size or with half as many threads in there "holding on." It doesn't take an aeronautical engineer to figure that one out.

Finally, remember that how accurately that torque wrench is used can mean the difference between life or death—yours and possibly the mechanic who *torqued* the nut too much, or not enough! For a long and prosperous life, let's all agree that there's only one correct solution to *torque*—JUST RIGHT.

# ARADMAC'S 8th Anniversary

**The Army's largest depot-level maintenance facility, ARADMAC, celebrates its eighth anniversary this year. From its Texas base at Corpus Christi Naval Air Station, it repairs the Army's mission-essential aeronautical equipment**

**Colonel Luther G. Jones**

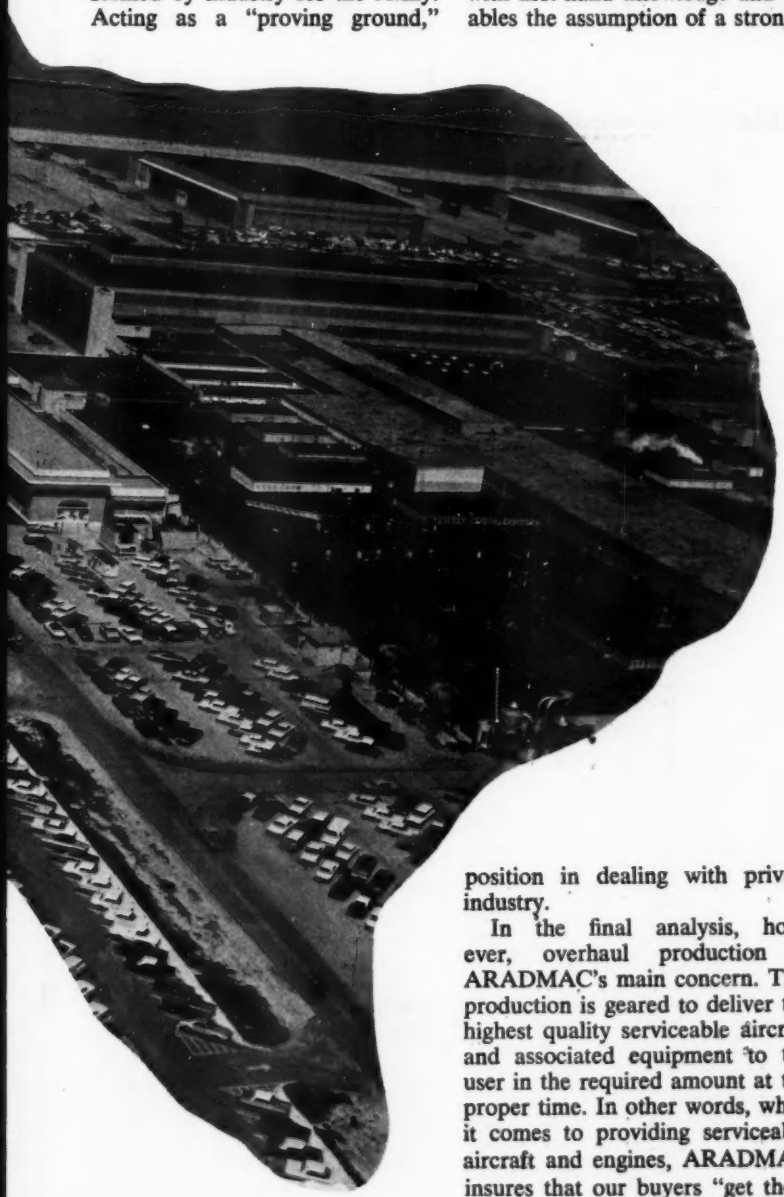
THIS YEAR marks the eighth anniversary of the establishment of the U. S. Army Aeronautical Depot Maintenance Center (ARADMAC) within the confines of the Corpus Christi Naval Air Station, Corpus Christi, Tex. ARADMAC operates under the direction of the U. S. Army Aviation Systems Command, St. Louis, Mo., and performs depot-level maintenance on the Army's mission essential aeronautical equipment. This service also is provided the U. S. Navy, Marine Corps and Air Force on a limited basis.

The seemingly improbable situation of the Army operating its largest depot-level maintenance facility in the heart of a Naval installation did not come about by chance, but as a result of calculated design. Previous articles concerning ARADMAC appeared in the DIGEST in November 1961; March 1964; April 1965 ("Project Flattop"); and September 1968. This facility originally was constructed in 1941 as a major Naval aircraft overhaul and repair site. It functioned in that capacity for 18 years until deactivated by the Department of Defense in 1959. Subsequently, the Army, recognizing the need for an inhouse capability of depot-level maintenance in support of its aircraft and associated equipment, petitioned the Department of Defense for approval to develop such a facility. After careful consideration, the present site was selected. Reactivation of the site took place on 22 February 1961 when the Secretary of Defense signed the activity into existence.

In addition to its primary maintenance mission, ARADMAC has other assigned responsibilities. They include avionics maintenance and calibration, maintaining a mobilization base, providing a maintenance technical training base, performing storage and distribution functions attendant to depot maintenance activities and providing

required worldwide mission support to the Floating Army Maintenance Facility.

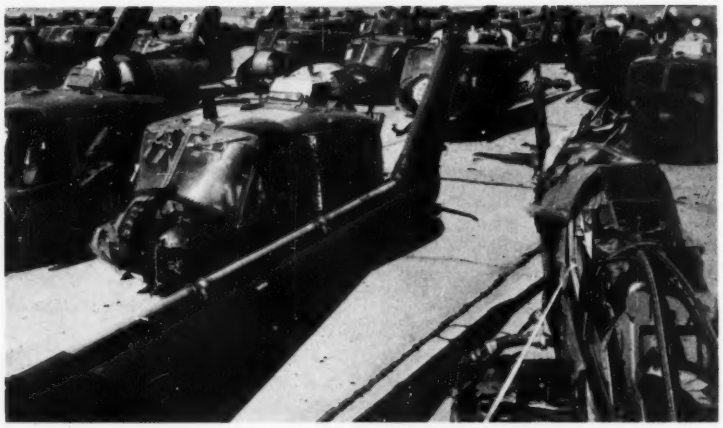
A by-product of the ARADMAC operation is that it provides the Army a means with which to compare similar operations performed by industry for the Army. Acting as a "proving ground," ARADMAC checks the validity of certain specifications prescribed by industry for Army hardware. It attests the reliability of established procedures and the necessity of certain requirements and items. This capability provides the Army with first-hand knowledge and enables the assumption of a stronger position in dealing with private industry.



In the final analysis, however, overhaul production is ARADMAC's main concern. This production is geared to deliver the highest quality serviceable aircraft and associated equipment to the user in the required amount at the proper time. In other words, when it comes to providing serviceable aircraft and engines, ARADMAC insures that our buyers "get there fustest with the mostest!" The importance of this capability became fully evident with the intensification of hostilities in the Republic of Vietnam. That buildup resulted in such greatly expanded Army aviation overhaul requirements that the greater portion of ARADMAC's accelerated effort is now expended in support of requirements in Southeast Asia. It might be said that during these trying times ARADMAC became of age.

Operations at ARADMAC began just six months after it opened its doors. The first aircraft, an O-1 (then designated L-19) liaison/observation type, and the first engine, an R-1820-103 type (used in the CH-21B Shawnee aircraft), rolled off the lines in September 1961. Since, about 1,384 aircraft have been processed; 20,540 engines have been overhauled and a staggering 193,075 aircraft components have been worked. An example of the increased tempo in production is the fact that 445 aircraft were processed in FY 68, exceeding the combined output of the first five years. Current production is increasing at an even faster rate, as 253 serviceable aircraft were produced in the first half of FY 69.

Engine overhaul has been even more dramatic—over 20,000 in eight years. Of these, more than 11,000 were T-53 and T-55 type turbine engines. The T-53 engine is the mainstay of the Army's rotary wing aircraft and comprises the largest portion of the engine workload at ARADMAC. It powers nine out of 10 helicopters in Vietnam. History has shown that Army aviation support would have been seriously impaired had not ARADMAC responded to the pressing need for serviceable T-53 and T-55 engines. Over 6,600 were turned out in FY 67 and 68. As it was in the case of aircraft, this production was more than the total



output of turbine engines in the first five years of operation.

The remarkable growth experienced by ARADMAC during its relatively brief existance also is reflected in the size of the facility itself. Initially, 60 acres of land with 22 buildings and $2,031,736 of capital assets and production equipment were transferred to the Army from the Navy. The total value was $9,111,185. At the end of the first year of operation, ARADMAC's work force totaled 1,249 civilians and 14 military. The latest figures, as of January 1969, reveal the present extent of the expansion to be:

• 119.4 acres of land containing 40 buildings, four miscellaneous structures, a 73,000 gallon capacity fuel tank farm and $23,824,000 of capital assets and production equipment. Total value —over 58 million dollars.

• 1,559,558 square feet of maintenance, administrative, supply and miscellaneous areas and troop quarters; 762,922 square feet are devoted to maintenance shop areas alone.

• A civilian work force of 4,564 and 28 military.

The foregoing statistics represent a 641 percent increase in the value of ARADMAC's capital assets and production equipment, a 199 percent increase in land area and a 363 percent employee increase. This growth was not merely the response to an immediate need arising from the confrontation in Southeast Asia, but also the natural evolution of a facility responding to the ever changing and increasing requirements in the field of Army aviation. From perhaps a limited muster of rather unsophisticated fixed and rotary wing aircraft of

Above left: a field of broken Hueys and Cobras await repair in ARADMAC workshops. Bottom left: a T-53 engine assembly line where final assembly prior to testing takes place. Right: like new again, these helicopters will go back to Vietnam for more combat

restricted capability, Army aviation has burgeoned into a complex, highly sophisticated, expanding operation that demands corresponding changes in the capability of its maintenance facility.

The keys to ARADMAC's success can be found in three areas: employee attitude and technical competence; the center's ability to adjust to new mission workloads and changing requirement; and the way ARADMAC is organized.

During the difficult and somewhat hectic tooling-up period following the opening of the center, ARADMAC was fortunate to have a ready source of skilled aircraft workers, eager to pick up with the Army where they left off with the Navy. This cadre of competent employees greatly reduced the con-

fusion accompanying the opening and enabled production to get underway sooner than anticipated. ARADMAC's employees have a keen sense of awareness of their position in the Department of the Army and the vital role they play in Army aviation. These employees understand that the nature of their product requires the job to be done right the first time—every time. They know that this fail safe factor, so essential to each aircraft, engine and component they produce, cannot be sacrificed to meet a production goal.

Initially ARADMAC's maintenance mission encompassed both fixed and rotary wing aircraft. Although fixed wing comprised a sizeable portion of the aircraft workload, combined output did not reach a high volume.

As the inventory of Army aircraft increases, ARADMAC is being relied on more and more to work on rotary wing aircraft only. The diversity and sophistication of Army aircraft necessitates this specialization. The programmed workloads are excluding nearly all fixed wing types and emphasizing only certain rotary wing types. These now include the familiar UH-1 Huey—widely used in Vietnam—the CH-47 Chinook and the AH-1G Cobra. In assuming the Cobra mission, ARADMAC is charged with the inflight test firing of the weapons system subsequent to repair of the aircraft.

As in the past, future missions will require corresponding changes in ARADMAC's operation and operating equipment. Such changes are already evident throughout the industrial and administrative areas. New and more advanced equipment has been acquired and installed and more is forthcoming. Numerically controlled machines have been purchased, greatly expanding our industrial potential. New Military Construction, Army, projects are underway to provide necessary facilities to support new workloads. The concept of production is swinging to the assembly line approach to provide the mass production necessary to accommodate increasing work requirements. The repair and maintenance capability at ARADMAC is now such that the most damaged and seemingly irreparable aircraft can be turned into a finished product that is almost indistinguishable from a new one.

Such capability, like ARADMAC itself, did not come about by chance. The effort and energy expended to achieve the present operating level would have been of little avail had there not been a cohesive agent to unify and direct all effort toward a common goal. This agent is organization. ARADMAC is organized, by regulation, under the directorate concept. The many functions of the center are accomplished by the directorate to which they are assigned, with each director reporting to the commander on the accomplishment of his particular mission. This procedure provides for the necessary close cooperation and mutual support of the various individual operating elements to achieve the overall mission of the center. Of major importance in accomplishing this is the interchange of reliable, sufficient and timely information needed by directors to render proper decisions, to plan and to execute. The bulk of this information is provided in the form of mechanized reports. Accomplishing this is a Honeywell Model H-200, 65-K tape oriented computer with nine tape drives. Reducing the raw data to computer input are 15 new NCR [National Cash Register] magnetic tape Encoders.

This, then, is ARADMAC today. But the ARADMAC of tomorrow will be just as different as the present is from the past. New missions, expanding requirements and changing techniques are a way of life at ARADMAC.

# Weight and Balance Sense

Major Chester Goolrick

NO MATTER WHAT some aviators seem to think, the law of gravity has *not* been repealed. It is exactly the same today as it was when Oog the Caveman was keeping a sharp eye out for falling coconuts. Everything which goes up is due to come down sooner or later, except maybe the price of sirloin steaks.

And flop down fairly hard at that, as a rule, unless there is a safeguard involved.

Nope, the law of gravity hasn't been repealed or even amended. The thing is that all of us, persistent critters that we are, have been trying for the last couple of thousand years or so to do something about the situation. Homemade wings flapped by one-man arm power. Gliders. Kites. Hot air balloons. It all seemed fairly hopeless until Wilbur and Orville came along and hooked a one-lunged engine to their flimsy contraption down at Kitty Hawk. The age of flight had arrived.

Nobody needs to be told what happened after that. Before anybody could draw a deep breath, the Red Baron was operating over the skies of France, people were flying the Atlantic in job lots and then around the world, and your dear old Great-Aunt Ada, age 90, was casually booking weekend trips from New York to Las Vegas to have a fling at the roulette wheels. They don't call Aunt Ada a charter member of the jet set for nothing.

You might say that if the law of gravity hasn't been amended, we have at least found ways to get around it. *Temporarily,* at least. Oog had trouble lifting the big rock he put in front of his cave door each night to keep out the sabertooth tigers, but he managed to do it with the help of his friends. As

for us, if there were any public outcry to turn Grant's Tomb into a jetliner and the idea looked profitable, you could bet that before long somebody would come up with a powerplant which could get it off the ground.

Under such circumstances, there is little wonder that it is a temptation for an airman to lull himself into a feeling that gravity has been suspended for the duration—that an aircraft's trusty engine will get him into the air and keep him there no matter what the load is or how it is arranged.

Else, how do you account for the number of accidents in Army aviation which have occurred because the rules regarding weight and balance—you might call them the antigravity shield—have been ignored?

It just happens—all too often.

It just might be worthwhile, as a quick brushup, to take a look at how the rules work and what has happened when they have been violated.

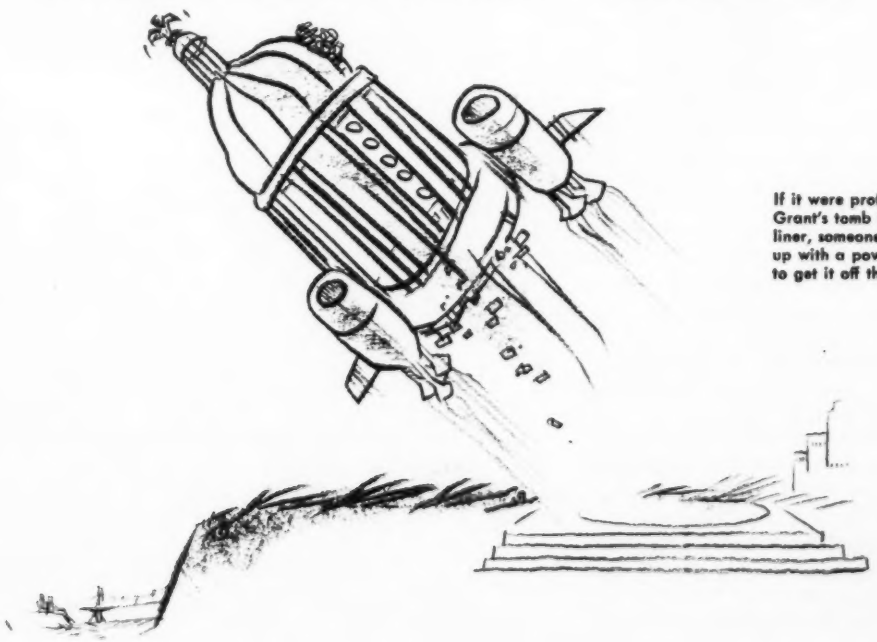
## WEIGHT LIFTER

One unchangeable fact is that a chap can't lift one ounce more than his muscles are built for without busting a gusset. The law of inertia, blood brother to the law of gravity, causes inanimate objects to have a firm desire to stay glued to one spot, like a Missouri mule. The heavier they are the more oomph it takes to get them started—up or sideways. There's always a limit involved. Not even an Olympic weight lifter is going to try to heft an anvil in either hand unless he wants to wind up with a set of muscles resembling guitar strings after a hard workout by a rock and roll outfit.

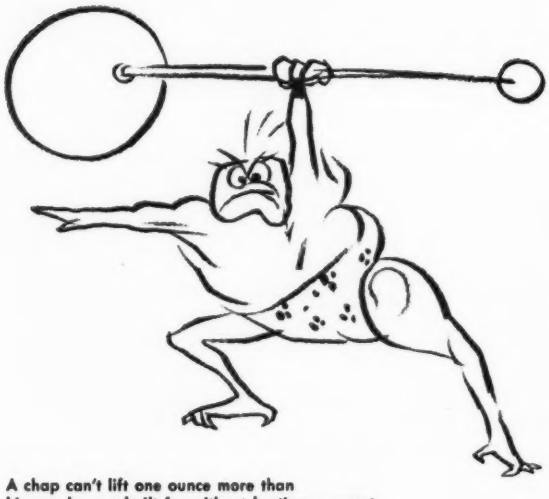
For an aircraft, vertical lift cannot exceed the powerplant's ability to heave aloft a given number of pounds under a particular set of conditions.

Everybody knows this, natch. But here is one thing that is frequently forgotten. ALL AIRCRAFT *CAN* BE *DANGEROUSLY* OVERLOADED. WHAT IS MORE, THEY *OFTEN* ARE.

It is common knowledge that any aircraft can take more punishment than the handbook recommends if the occasion seems to demand it. Manu-



**If it were profitable to turn Grant's tomb into a jet liner, someone would come up with a power plant to get it off the ground**



A chap can't lift one ounce more than his muscles are built for without busting a gusset

facturers build in something extra, the way the soft-hearted sodajerker used to slip you an extra scoop on your ice cream cone when you stopped by on the way home from school. That doesn't mean that an aircraft, fixed or rotary wing, should be pushed past the red line, except in the direst emergency. Sometimes, when the density altitude (DA) has soared out of sight like an Apollo rocket bound nonstop for the moon, an aircraft can be pushed too far. It will cling to the ground with a grip of steel. You just might be able to coax it into the air by using spurs and horsewhips. You are not going to coax it very high or very far.

Just the same, the temptation is there for a pilot who doesn't know or fully respect his dash 10. The temptation to forget the limitations. To overlook them. Or, what is probably the case 99 times out of a hundred, to gamble.

Gambling can be great sport, if you can afford to lose.

As your Aunt Ada might observe when she jets back from Vegas, some days you win and some days you can't make a nickel. The reason all horse players die broke is that when they were young, they were falsely encouraged by the occasional long shot winner Lady Luck handed them on a platter.

You might call it bait to catch suckers.

## YOUR MONEY DOWN

There are about as many ways to gamble at Vegas as there are to catch the common cold. The odds always favor the house.

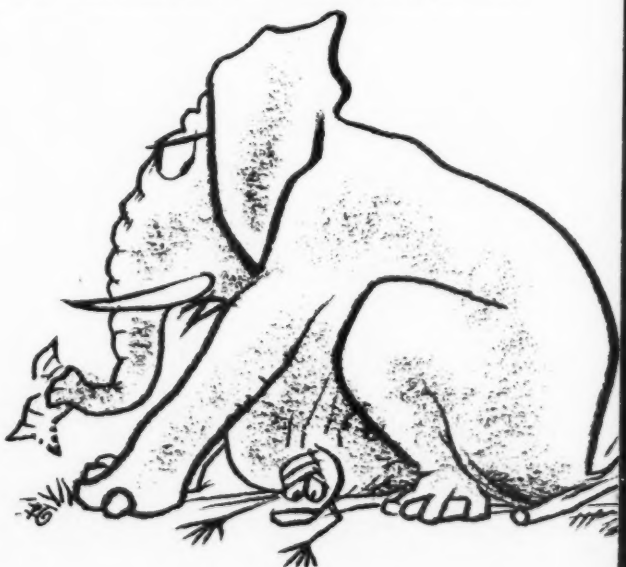
There are several interesting means by which you can gamble with weight and balance with Army aircraft, particularly helicopters. You might well win for a while, too, but don't worry. The odds catch up with you in the end.

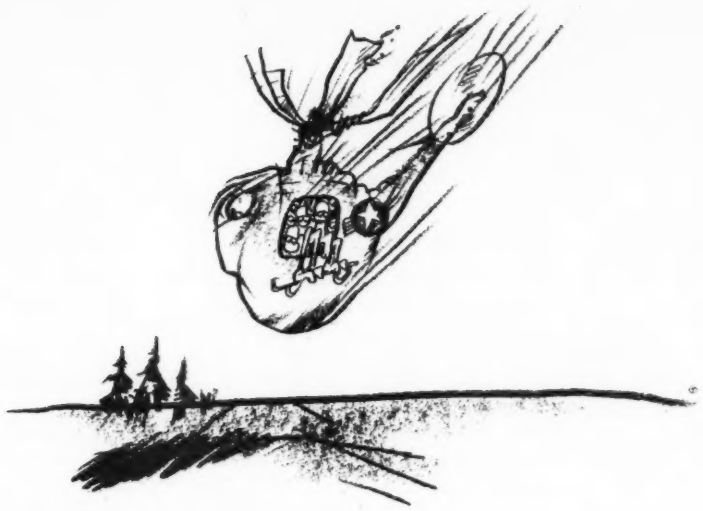
• You can grossly overload an aircraft under the simple theory that it will obligingly haul upstairs anything you can cram into it. This is known in gambling circles as the Beginner's Approach and is not recommended by old hands.

• You can make a hasty estimate of the weight and balance situation rather than arrive at an exact figure. This is the mark of the born gambler. All *born* gamblers are due to *die* broke.

• You can forget about the whole thing, ignore the odds. People like this aren't even allowed at the tables at Vegas. They make the other players nervous.

• You can look at one aspect of the situation and forget the other. In gambling circles this is referred to as Blind Man's Bluff and nobody will argue that it





All aircraft can be dangerously overloaded. What is more, they often ARE

isn't as exciting as all get out. As long as it lasts, which probably won't be too long.

One long-shot way of gambling is to tinker with density altitude.

## A LOT OF HOT AIR

The big trouble with density altitude is that you can't see it the way you can a charging rhino or a runaway diesel tractor-trailer. When a pilot about to take off is confronted with a thunderhead which looks like the after-effects of a 20-megaton nuclear blast, he prudently stays on the ground. The same airman, no matter how experienced, can be capable of sailing blithely off into the wild blue yonder on a sunny day which is every bit as lethal for an aircraft which has been loaded with no thought of DA.

The heavier they are, the more oomph it takes to get them started

It's no great secret that hidden dangers are the ones most likely to trip you. If Lucrezia Borgia's dinner guests had been able to taste the deadly doses she slipped into their wine, her list of victims would have been considerably shorter. If you could taste DA, or feel it the way old soldiers predict weather when the wound they got on D-Day begins acting up, there'd be no problem at all.

DA may be hidden from you. It isn't hidden from Army rotary wing aircraft, which are as sensitive to sudden changes as a skittish colt. On a sunny July day, Ft. Rucker *looks* the same at noon as it did at breakfast. No new mountains, or anything. Just the same old flat Alabama landscape we all know and learn to love.

But no Huey in its right mind is fooled. It knows that while Rucker's actual altitude is under 400 feet, its density altitude varies between minus 1,000 and plus 4,000, depending on the time of day and the mood the sun is in. To a hard-working Huey that makes the difference extra pounds do to a horse in a handicap race. It will tell you so, too, and in no uncertain fashion, if you load it with no thought to DA.

Rucker is not an exception. There is hardly any place where Army aircraft are operating that DA ranges can't vary widely on a day-to-day basis. A jungle which can be comparatively cool at night can be steamier than a Chinese laundry by midmorning. You can very nearly freeze to death on arid terrain during the dark and a few hours later feel like those three lads in the Bible who were tossed into the fiery furnace. It may be that under such conditions the weather might bug you to the point where you could forget about DA. Your faithful helicopter won't.

You can gamble with weight and balance for a while, but in the end the odds catch up with you

You'll have to hand it to an overloaded helicopter in high DA conditions, though. It will give the job assigned it the old college try, even though it knows something the pilot doesn't—that it is being asked to take a hurdle it can't get over. It will even send out distress signals asking for somebody to put an end to the proceedings before it is too late. If the distress signals are ignored, you can't blame what happens next on the chopper.

Consider the following unhappy one-act drama. A pilot of a UH-1C about to set off on a mission in Vietnam tried to hover out of a revetment. With 900 pounds of fuel, extra ammunition, and a full complement aboard, the helicopter made a mighty effort, but couldn't get airborne. This was warning No. 1, which the pilot ignored. Instead, he made the gunner and crewchief walk to the POL, where 100 pounds more fuel were added. At this point, there was a delay in the mission. When the pilot tried to hover back to the parking area he found again he couldn't get off the ground without losing rpm. Warning No. 2. Eventually, the mission got off after an ammunition box weighing under 100 pounds had been unloaded. Or, at least, the mission got *partway* off. The poor Huey, which had been doing its durndest to let people know what was wrong, dragged its skids along the ground, lurched aloft like Dumbo, the flying elephant, and crashed into a tree.

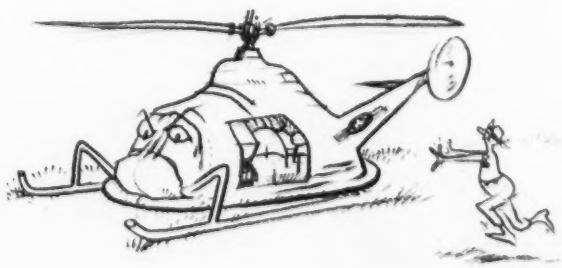
This whole dismal episode is such a classic example of density altitude bungling and overloading, it should by rights be set to soft, sad music and turned into a TV soap opera. When the investigators arrived on the scene, pencil and pad in hand, and started totaling up the figures, they discovered the chopper's weight had been 8,360 pounds. That was in the neighborhood of 120 pounds over the maximum allowable for prevailing DA conditions. If you weighed 8,360 pounds you might figure another 120 pounds or so wouldn't make much difference.

You probably wouldn't feel much like flying, either.

Neither did the helicopter.

Another interesting side to our one-act drama was that the pilot (after he recovered) contended the

In gambling circles this is known as Blind Man's Bluff



assigned mission would have been impossible without the extra ammunition and fuel. That's something else you will run into occasionally—the kind of left-handed logic which holds that an aircraft can handle any kind of load for any kind of job, regardless of load or DA, if the mission is considered necessary. As matters turned out, this particular mission fell a little short of being the most successful in the history of military aviation. If there were any Vietcong hiding and watching back in the rice paddies, they must have gone away thinking they had had a fairly successful day without any effort on their part.

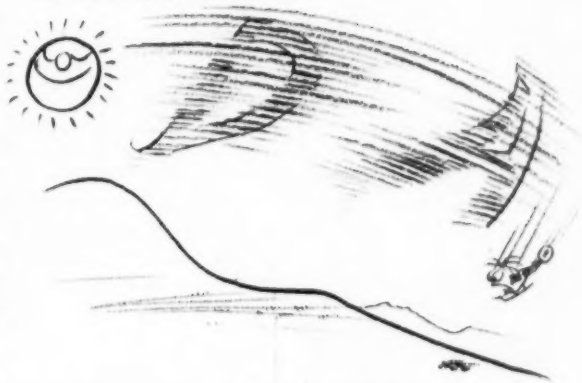
The fault here was simple and all too common. The pilot did not *calculate* the density altitude—he estimated it. And if you don't think there is a world of difference, try estimating your girl friend's weight sometimes. You are going to be in the market for some fresh female companionship if you err on the heavy side by as much as a scant pound or so.

Whenever load and weather conditions warrant, which is a considerable portion of the time—

## DENSITY ALTITUDE IS COMPUTED BEFORE WEIGHT AND BALANCE

Maybe that's not always possible in a rapidly changing operational situation. True. But every pilot who really knows his handbook can tell when his aircraft has about as much load as it can reasonably be expected to handle under *any* DA condition. If he always assumes the DA to be higher than it actually is—the way he would shave a few pounds when he guesses his girl's weight—chances are he won't

The big trouble with density altitude is that you can't see it



stray into territory labeled forbidden by the dash 10 tables.

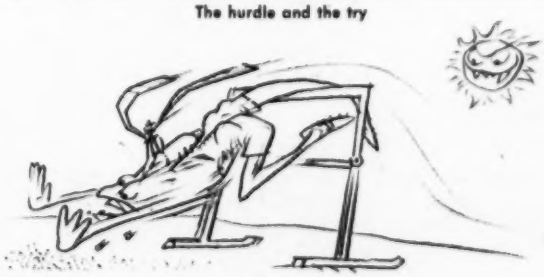
He'll never be caught off base. Ballplayers who can say the same thing after 10 tough years in the majors are the ones the others on the team look up to as the real pros.

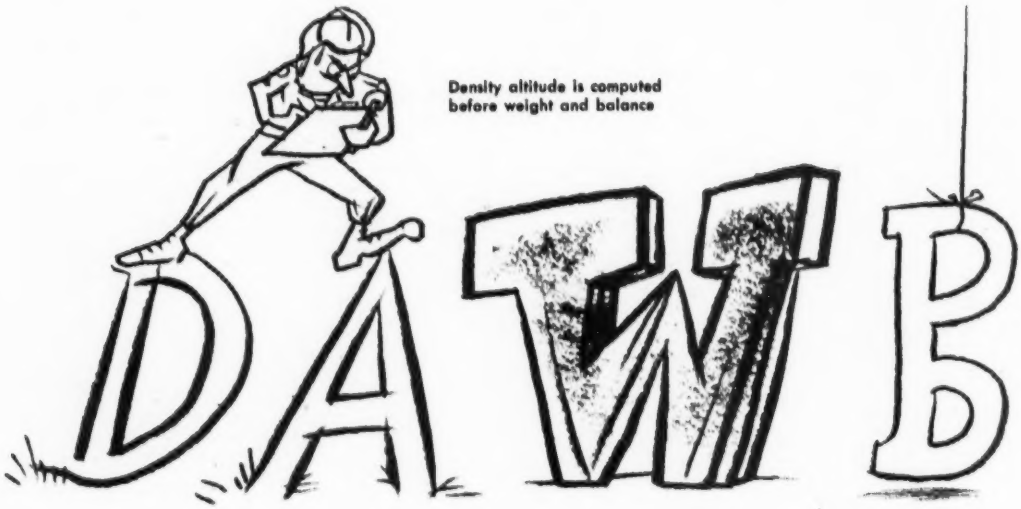
## TOUCHING *ALL* BASES

If he is never nabbed off base by density altitude, a real pro will never be caught napping by other aspects of the weight and balance problem. The difference between a pro and a rank greenhorn in this respect is the same as that between an Arab who has a hazy conception that if you pile too much straw on a camel you will break its back and the one who knows to the last ounce how much you can load on and still get maximum performance from start to finish on the caravan across the Sahara.

If you are on the hefty side and want to work off enough poundage to keep the girls from breaking

The hurdle and the try






into hysterical giggles when they pass you on the beach, you begin counting calories. It isn't the density altitude that bothers you, it is the day-to-day matter of what you can take on in the way of baked potatoes (90 calories each), martini cocktails (145), or double-dip banana splits (approximately 8,360). As a charter member of TOPS (Take Off Pounds Sensibly), you take a stern look at the whole picture, understand the problem, and keep plugging away. If you lapse, you're in trouble. The girls will keep on giggling.

Some fortunate souls, envy of their fat friends, don't have to worry about their weight. They are constructed so that they can put down enough calories on a day-to-day basis to founder a man-eating tiger and still never gain an ounce. Most of us, worse luck, have to watch our waistlines.

In Army aviation, weight is *everybody's* problem. It is true the helicopter is about as sensitive to density altitude changes and weight loads as a hay fever sufferer is to milkweed and goldenrod, but even workaday fixed wings can become balky if you put too much of a burden on them.

A Seminole or a Beaver can be wrestled into the air with a considerable overload. It is a sad fact that such sloppy procedures have become almost standard in the past in some units where the full implications of the weight problem have not been given the careful attention they deserve. But flying of this sort—if you want to be kind, and call it flying at all—demands maximum performance by the aircraft. There is nothing in the Bill of Rights of the U.S. Constitution which guarantees any airman maximum performance at any time. You can induce a Seminole to take off with full fuel tanks, a complement of beefy passengers, and enough baggage to last on a leisurely 80-day tour around the world. So, all right, you get airborne. Now what happens if you run into icing conditions and a little later one of the engines comes down with a severe case of Hong Kong flu? Do you *remain* airborne? Not on your life, you don't.

What you can turn into is another victim of gambling, of losing your bankroll, of stacking the deck against yourself as neatly as any Mississippi gambler could have done it for you in the old steamboat days.

It has happened, too. It is definitely not to be

If you don't touch them all, forget it

classified as horror fiction along with such masterpieces as Frankenstein or Count Dracula. The gambler-pilot involved in this throw of the dice wound up more deeply in the red than most. It's a fact that *any time* you improperly load an aircraft you are imposing additional stresses which are not going to improve its flying performance or lengthen the time before it will have to be retired to pasture. An overloaded Beaver needs a longer runway to overcome inertia sufficiently to get it in the air. When it comes down it requires a longer rollout to overcome its momentum. Between takeoff and landing it can be as sluggish as a frog on a hot rock or be subject to attacks of temperament which make it about as hard to handle as a Hollywood star. It gobbles more fuel. It climbs and moves along like an elderly gent with arthritis in both knees. When the pilot gets home—provided he *does* get home—he feels as if he had spent the day wrestling a bull alligator.

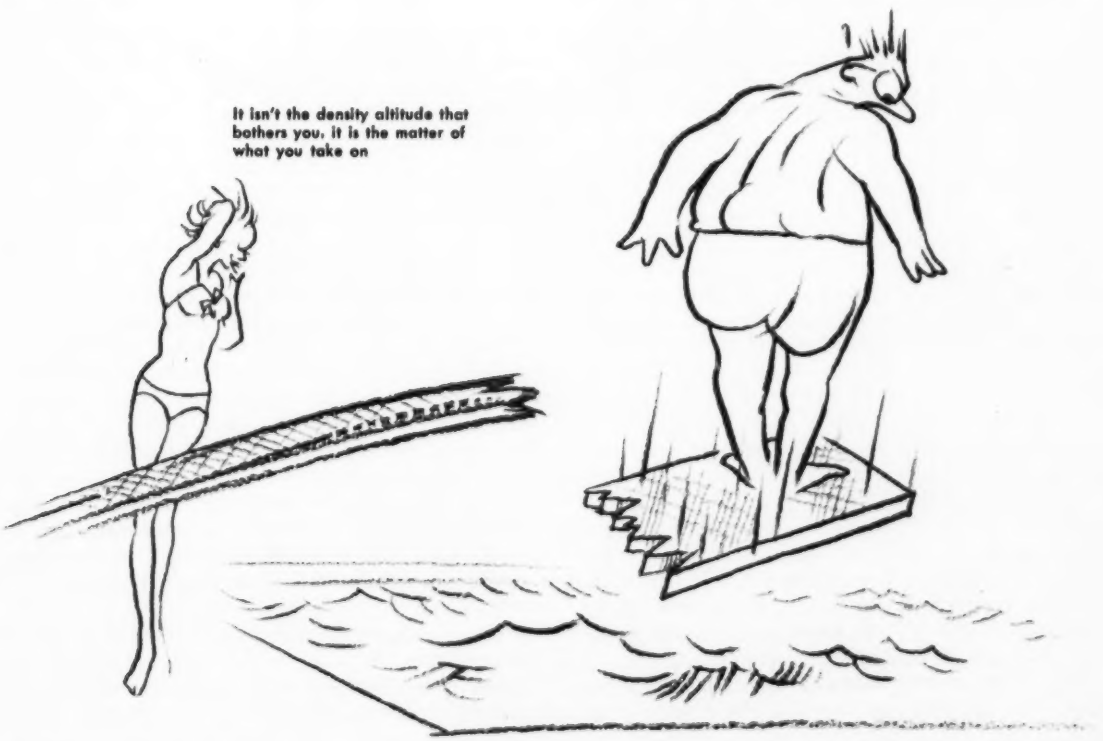
He may not have actually lost anything by his gamble. You couldn't say he has exactly hit the jackpot, either.

## TEETER TOTTER

Weight is one thing. Balance is another. The two have a definite connection, though, as the fat lady remarked when she started out on the tight rope.

Weight is a simple matter of pounds and ounces. Balance is how it is distributed, which is what keeps a girl looking like Venus de Milo instead of a sack of Idaho baking potatoes. Three rousing cheers, men, for weight *and* balance.

Nobody who has eyesight much keener than that of a mole, and has the instincts of a normal, red-blooded American boy is very likely to confuse the silhouette of an Army aircraft with that of Venus de Milo or Raquel Welch. The balance factor is there, just the same, to a greater or lesser degree, with all aircraft. We are talking, of course, about center of gravity—CG, as it is called by its friends—which determines whether an aircraft stays on the straight and narrow with little sweat or strain or goes wobbling along like a man trying to navigate his way home after the reunion banquet of the outfit he flew with back in World War II. It can be a distressing sight. A Beaver with 100 pounds aft and only the

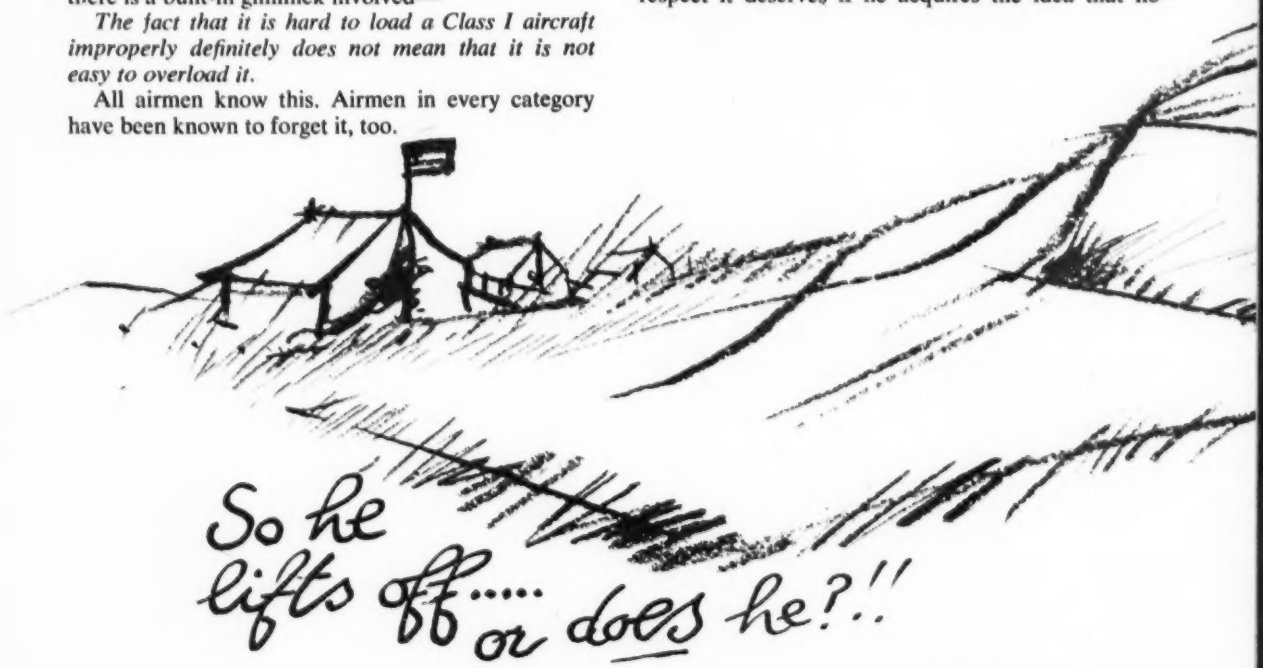


pilot up front is in just about the same tail-heavy state.

Class I aircraft, which are hard to load improperly unless you try the curious experiment of strapping a few sandbags in an unlikely place, aren't particularly bothered by CG. Stay within limits for each compartment and the CG will take care of itself. But there is a built-in gimmick involved—

*The fact that it is hard to load a Class I aircraft improperly definitely does not mean that it is not easy to overload it.*

All airmen know this. Airmen in every category have been known to forget it, too.




Because he doesn't have to be as fussy over his aircraft's balance as a young mother sending her youngster off for the first time to kindergarten, because he doesn't normally have to fill out weight and balance forms, a Class I pilot can be capable of overlooking the *weight* factor. Maybe he forgets to add in the lumpage of his passengers. Or overlooks the fact that baggage also packs pounds, something anyone who has ever carried a suitcase from one end of an airport to the other has had impressed upon him. So, the pilot sets off on his mission without the reserve capability his aircraft will need if he runs into unexpected conditions. If you will kindly refer back to the U-8 incident, you can get a fair idea of what could easily happen next.

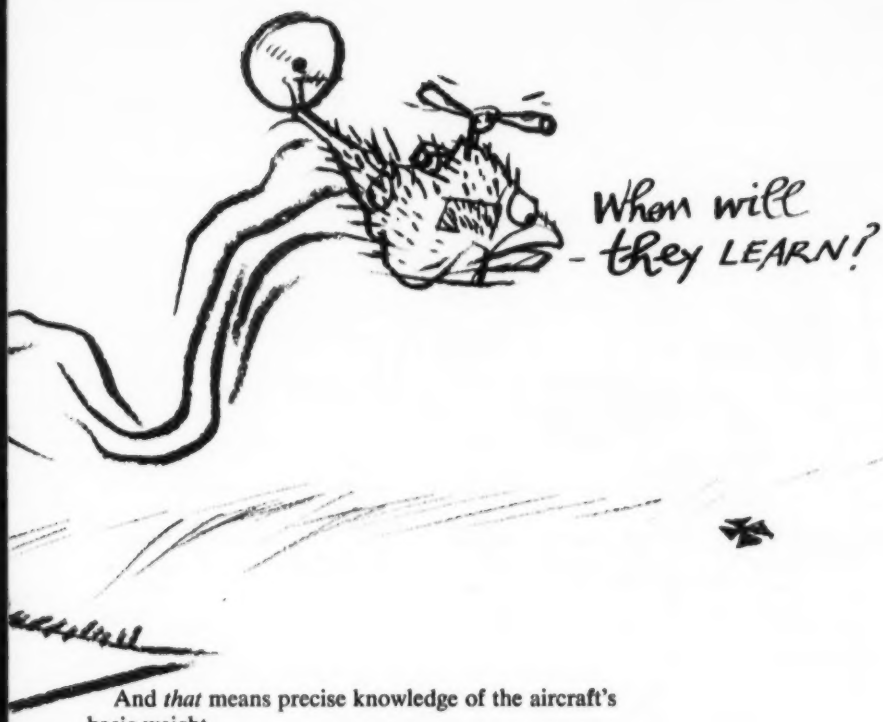
Bear in mind that, much to the Army's distress, pilots like this who are careless about weight requirements aren't exactly as scarce as watermelons in Greenland. Bear in mind, too, that they don't fall into such sloppy habits all by themselves. They are the products of units which lack sound training programs or up-to-the-mark supervisory procedures. You can't expect any airman, no matter how conscientious, to give the weight and balance factor the respect it deserves if he acquires the idea that nobody else thinks it has any critical importance.

## ANNUAL CHECKUP

Take the matter of weighing Class II aircraft, for instance. If a Class I can't be improperly loaded with ease, Class II are a different kettle of fish; some are as sensitive to the balance and load business as the Playgirl of the Month. If you hand so much as a stick of chewing gum to the chap in the next seat you are likely to throw the whole thing out of CG.

Well, maybe not all *that* sensitive, but sensitive enough (look at the need for shifts in the balance bar and sometimes the battery in some aircraft) to make balance something all Class II pilots should be as wary of as a pickpocket is of the cop on the corner.

*And* that means accurate completion of the required form before each flight.



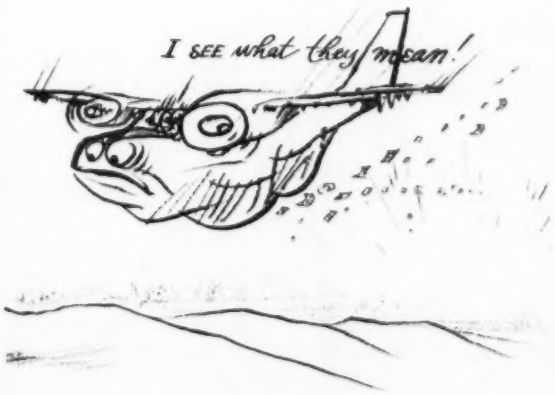

And *that* means precise knowledge of the aircraft's basic weight.

Which means scales. No pilot can be expected to figure his gross weight accurately, any closer than he can guess the number of beans in a jar, if he doesn't know what the aircraft weighs to begin with. Regulations say aircraft must be weighed periodically, at least once a year, and when major modifications are made or unsatisfactory flight characteristics develop. This is sound, common-sense reasoning no one will want to quarrel with.

Not to *quarrel* with, maybe. Just forget about. One accident not too long ago was traced back to the fact the unit involved did not even own a set of scales. There was no accurate way of knowing whether an aircraft should have its calorie intake lowered or not. At that, the unit was no worse off than others who *do* have scales but which aren't using them the way directives prescribe. A pilot in this case still has to rely on guesswork when it comes to weight and balance. A miss can be a lot worse than a mile.

## HIT OR MISS

Gambling or guesswork. Guesswork or gambling. Over the long haul they add up to about the same thing. Any way you slice them they spell poison to an aviator who has higher stakes out on the table than you will ever see at the Saturday night penny ante poker game.




A case of stacking the deck against yourself

## WEIGHT AND BALANCE SENSE

An overloaded Beaver is subject to attacks of temperament which make it as hard to handle as a Hollywood star

Gambles and guesses simply are not the hallmark of the airman who thinks of himself—and rightly so, too—as a true professional. Sure, there may be times when an educated guess becomes necessary, but there is a considerable difference between predicting tomorrow's weather—based on the facts available—or the density altitude at the destination of your flight—and trying to draw to an inside straight. You can pull off the latter every now and then, but not very often, and when you do it is a matter of plain dumb luck.

Plain dumb luck has no place in the weight and balance situation—or in any other aspect of Army aviation, either. Every now and then, though, you run across a depressing incident which gives rise to the dark suspicion that maybe some pilots aren't always acting like the real pros they have been taught to be. There was a classic case a few years ago involving the venerable old H-21. Several of them were assigned the task of carrying troops from a point at low altitude to one up in the hills. One of the helicopters broke down at an intermediate point and the pilot of another, obliging soul that he was, loaded aboard the stranded troops. Not that they ever got there. Long short of the destination, rising actual and density altitudes forced the laboring Shawnee to a messy landing in a patch of woods.

Here was a pilot who had given no thought to the mission as a whole from takeoff to touchdown, not in the way the pro would handle it. Instead, using his own crystal ball, he managed to arrive at the

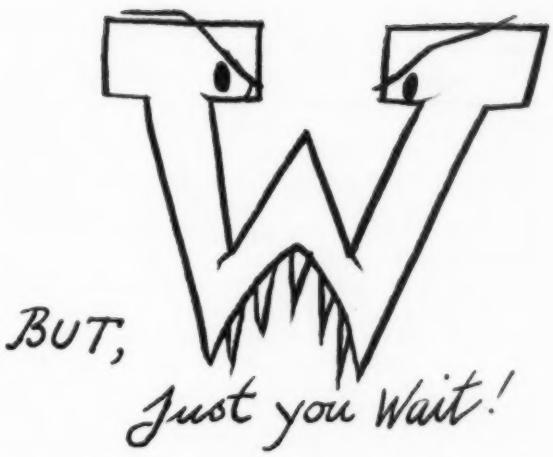
conclusion that he could pack aboard more customers than they do on subways at the rush hour and still land them safely at a place where even Alpine climbers would have trouble handling the thin air. He was wrong.

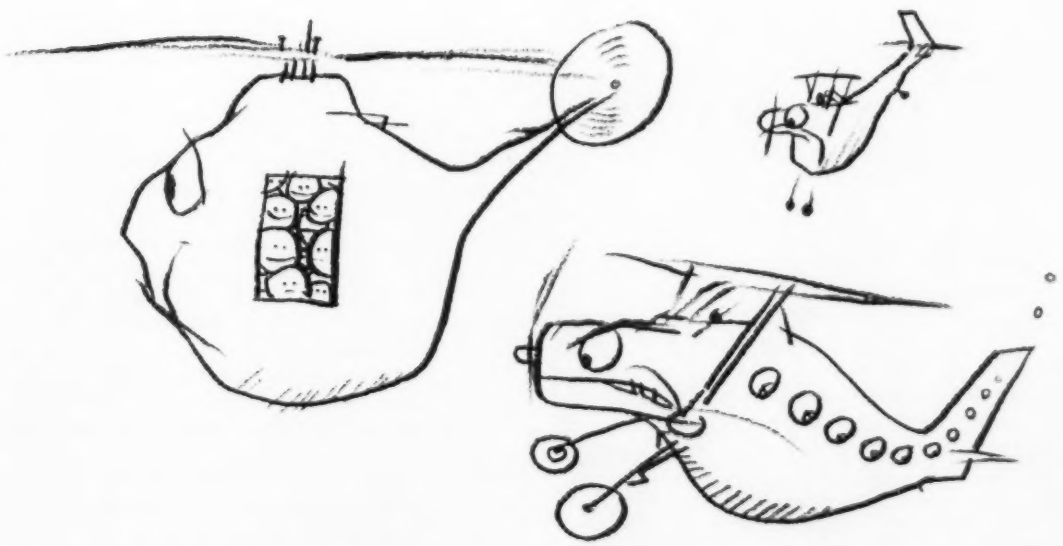
Guesswork? Talk to scientists down at Cape Kennedy about it some time. If you don't already know, they'll be happy to tell you that if guessing played any part in their scheme of things the Apollo rockets would still be straining to get off the pad.

OUNCE OF CURE

The nice thing about weight and balance disease, when it strikes, is that you don't even need a pound of cure. Just a few well-placed ounces will turn the trick nicely.

One of them is cultivation of a healthy attitude toward flying, in particular your aircraft. A touching faith in its powerplant to work almost any miracle is sometimes understandable, but it is a sad fact that miracles don't come a dime to the dozen since King Arthur and Merlin departed from the scene. As we've



noted, every aircraft has definite limitations—and never forget that those limitations are set by the condition of its own health. You might get a near-miracle from a helicopter for a while, but only as long as it can deliver maximum performance under optimum conditions. For instance, everybody knows that it is not unusual for a helicopter to lose rpm on takeoff. You won't get the miracle you are asking for when that happens to you in an overloaded helicopter when the DA is high.

About the only miracles being passed these days are the result of solid hard work and unremitting attention to detail. As a matter of fact, once you have that lesson under your belt you don't need any miracles. A topnotch performance takes care of itself without any need for a crutch or a bailing bucket.

How do we bring about this happy state of affairs? Well, you sure won't find it in units which don't even have a pair of scales. That kind of thing is strictly bush-league, a long way from front-rank professionalism. Where you *will* find weight and balance given its proper share of respect, together with all the other problems which rise to plague us, is in units which have sound training and supervisory programs aimed at impressing younger pilots with the importance of weight and balance and keeping old hands from forgetting about it, or falling into gambling habits which would make Bet-A-Million Gates throw up his hands in horror.

Training and supervision can go only so far. After that it is a matter of mature responsibility. When a doctor tries to impress an overweight patient with the need for a rigid diet and calorie-counting if he really wants to take off blubber, and then catches him in the nearest ice cream parlor gobbling down double-dip sundaes, he has every right to wonder whether the patient is the mature citizen he is cracked up to be.

It is the same with Army airmen. Weight and balance and density altitude, like calories, are fixed facts of life. Pretending they aren't there, or can be tinkered with, isn't going to make them go away.

It is just going to weigh on you that much heavier. That's all.

# PEARL'S
## personal equipment and rescue/survival lowdown

## quotes from recent accident reports

*U-1A*—"The crewchief was not wearing a helmet. The scalp lacerations he sustained would have been prevented had he been wearing his helmet. He stated that he left it behind because it gave him a headache.

"The battery, ladder, luggage and other items in the rear compartment of the aircraft were thrown forward to the front of the passenger compartment and the crewchief sustained battery acid burns on his chest and back.

"Inspection of the pilot's helmet revealed that the pads were mounted in the helmet with an adhesive which dissolved much of the styrofoam. Since the pilot suffered skull fractures, it is the opinion of the flight surgeon that the loss of compressibility of the foam lining could have contributed to his death."

Note: The type of adhesive used is not known as this is written. An attempt is being made to identify the adhesive and this information will be published as soon as it is available. The function of the styrofoam liner is to absorb and dissipate crash impact forces. Anything which tends to reduce the thickness of this liner lessens *your* crash injury protection.

UNSECURED PASSENGERS

*UH-1D*—". . . the aircraft spun to the right, shearing the tail boom on a tree and throwing two of the three passengers out. . . ."

*Passenger:* ". . . the ship bucked through the air and slid sideways throwing me out approximately 10 to 12 feet in the air. I was knocked unconscious and had abdominal contusions."

*Passenger:* ". . . As the aircraft tilted to the left, I was thrown from my position in the left gunner's well about 15 feet to the ground. I rolled and kept rolling, as it seemed the aircraft was going to land on me. I sustained back injuries."

*Review:* "Two passengers, apparently unsecured, were thrown out at initial impact and injured. No recommendations concerning this were made by the investigating personnel or the flight surgeon. Recommend review of chapters 12 and 14, AR 95-5, for preaccident planning."

UNSECURED CREW

*UH-1D*—"We were just about to take off when the left side of the aircraft got up, but the right side did not. I was about to fasten myself in at that time,

*If you have a question about personal equipment or rescue and survival gear, write Pearl U. S. Army Board for Aviation Accident Research Fort Rucker, Ala. 36360*

but did not because it happened so fast. I was thrown out of the right door, but was not injured."

*Review:* ". . . No action was taken to insure that all personnel were properly restrained in their seats prior to takeoff. The gunner was thrown from the aircraft during the crash sequence, luckily escaping injury. . . ."

UNSECURED PASSENGERS AND CARGO

*UH-1H*—". . . The crew was assigned the mission of resupplying a unit. On the third flight, the cargo consisted of mortar ammunition, much of which was white phosphorus. In addition to the cargo, there were four passengers to go to the unit being supplied. The passengers were seated on and around the cargo, without seat belts or any form of restraint.

"During the approach, at approximately 20 feet, the main rotor struck a large limb near the top of a tall tree. A ground guide was directing the aircraft and did not see the tree. The doorgunner was leaning out, clearing the tail rotor, and he did not see the tree. A witness stated that the limb was dislodged by the rotor strike and fell through the rotor disc and was struck again. The helicopter rolled to the right and fell to the ground.

"The crew and two of the passengers were able to exit uninjured. Two of the passengers were trapped under the cargo and fuel began to burn almost immediately. All efforts to free the two remaining passengers failed. . . ."

*Flight surgeon:* "This is another of those regrettable accidents in which needless deaths occurred. . . . The crew extracted themselves without difficulty, with the exception of the right doorgunner, who experienced difficulty with his seat belt and had to push gear out of his escape path. . . . The cargo was not secured to the aircraft and the cargo configuration precluded the use of passenger seats. They were seated on or in front of the cargo and no passenger restraints were in use. The passengers were not required to roll down their sleeves. . . . Rescue of the two passengers trapped by the cargo became impossible as fire broke out shortly after impact. . . .

"When I interviewed the crew, I asked whether the passengers and cargo were secured and whether the passengers' sleeves were down. They answered that they did not know, but they didn't think they were secured because the seats were not down. I asked whether they realized that it was against safe flying and command regulations to fly with unsecured passengers and cargo and they replied that it was done all the time. . . .

". . . Several supervisory factors are also evident, such as the aircraft commander's failure to take full responsibility for the human and nonhuman cargo, and failure of the unit commander to demand safe flying practices.

"If you begin with the premise that preventable deaths will not occur, certain things follow. The aircraft commander must assume the responsibility that is rightfully his. He must be made to realize that this responsibility extends to the aircraft, the mission, the passengers, the cargo and the crew. Aircraft commanders who will not assume this responsibility should be relieved. Commanders must demand safe flying practices and enforce these demands. . . .

"Recommend that existing regulations concerning aircraft and passenger safety be vigorously enforced and that all cargo and passengers be secured to the aircraft, except when combat situations require immediate unloading."

LOOSE CHIN STRAP

*UH-1D*—". . . After refueling, the aircraft departed the POL area on a heading of 220 degrees with a reported wind of 9 knots from 150 degrees. At approximately 30 feet and 50 knots, the aircraft commander heard a loud noise from the rear of the cabin and engine rpm dropped. The aircraft settled to the ground and skidded 212 feet over rough ground before hitting a 3-foot dirt mound with the left skid and left rocket pod, causing one main rotor blade to strike the tail boom, cutting it off at station number 380.

"The aircraft skidded 60 more feet at a 30-degree angle to the original skid tracks, while completing a 180-degree turn, and came to rest on its right side.

*". . . The aircraft commander sustained a head injury because his helmet came off on impact due to the fact that his chin strap was unfastened."*

PLEASE CUT ALONG LINE AND DISPLAY IN PROMINENT PLACE

Have you heard the many complaints,
From those who fail to use them,
About helmets and restraints,
And how they'd like to lose them?
Loose cargo and passengers aboard,
Broken blades upon a tree,
Tiedowns and harness ignored,
That's no place for you and me!
Wise up and fly restrained,
Use your gear the way you oughter,
We'd like to have you back again,
To live with your mother-in-law's daughter!
Shelley Fabares, MGM
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# MIRACLE at Fort Bastille

Ted Kontos

Forget Friday and start fresh on Monday . . . he envisioned rare steaks, champagne, soft music and Claudette

*CPT Ben Watts was sent to find out all he could about Samson A. Meanwell, but he was not prepared for the experience awaiting him at Fort Bastille*

IT HAD BEEN A long week and CPT Ben Watts, newly appointed safety officer, was glad to see Friday afternoon roll around. He glanced at his wrist and saw the time was 1610. Five more minutes to go. He reached for a stack of maintenance accident summaries on his desk, riffled the pages, then shoved them into a drawer. His mind filled with questions. Practically all maintenance-caused mishaps were repetitions of previous ones. Why, then, couldn't they be stopped? He pushed himself away from his desk and lifted his lanky frame from his chair, shrugging. If he hadn't been able to find a cure in 5 days, he surely couldn't expect to find one in 5 minutes.

He strode to the back door of the frame structure and stepped onto the concrete porch. The bright rays of the June sun warmed his skin. He inhaled deeply and sighed. Maybe he was taking his job too seriously. Maybe his CO was right in telling him not to expect miracles. But that was just what he needed—a miracle.

Across the expanse of green lawn, he saw a red convertible in the parking area. As usual, Mrs. Donaldson was waiting for her husband. It was a sure bet that the Donaldson family would be on the golf course within a few minutes. Already, the two boys busied themselves with their new golf clubs. While the younger boy putted, the older, who looked to be 12 or 13, practiced with his driver. He watched as the boy addressed the ball and started his backswing.

Sounds of shuffling and the clatter of desk drawers being slammed warned that quitting time was near, and CPT Watts knew better than to block the doorway. He turned about and started back inside. With his first step, a sudden strangeness overcame him—a weird feeling that he had been mysteriously changed into someone much unlike his usual self. He hesitated, shrugged, and marched to his desk.

He picked up the IN box and dumped its contents into the OUT box. Then, with one magnificent sweep of his arm, he cleared his desk top—into the wastebasket. Forget Friday and start fresh on Monday. That was the way to operate. The weekend was what counted and he fully intended to make the most of it. He envisioned rare steaks, champagne, soft music and Claudette. Ah, Claudette!

The incessant ringing of the phone cut his thoughts short. Wrong number, no doubt. Only an imbecile would call at this late hour on Friday. He snatched up the receiver. "Captain Watts, sir."

"Glad I caught you in," said MAJ Donaldson. "Got any plans for the weekend?"

"Well," CPT Watts countered, "I was having some trouble choosing between a weekend with Claudette or a lecture on the possibilities and probabilities of early detection and confirmation of causative factors involved in incipient engine failures."

"Very funny!" MAJ Donaldson fired back. "I'm going to do you a favor. I'm going to save you the trouble of having to make such a tough decision. I'm sending you to Fort Bastille in the morning. Stop by and pick up your paperwork and ticket. I want you to find out all you can about this Meanwell fellow."

"Meanwell? What Meanwell, sir?"

"If you'd open your mail, you'd know what Meanwell! Samson A. Meanwell, that's what Meanwell!"

"But, sir! Fort Bastille is a long way from here, and—"

"I'm glad to hear you haven't forgotten your navigation," the major cut in. "I suggest you get started!"

"But, sir! Sir? Sir?" his voice dwindled to a whisper. The major had hung up. The world was against bachelors, particularly bachelors with girls like Claudette. "I won't go," he muttered. "I will not go!"

His flight was uneventful. The DC-8 was smooth and quiet, the stewardii pretty and impersonal and they arrived on time. He checked to make sure he had his orders, rented a car, loaded his bag in the trunk, placed his camera on the front seat and climbed in. He thrust the key into the ignition, gave it a twist and depressed the accelerator as the engine caught. He left the airport and turned toward Fort Bastille, 20 miles away. The sooner he got there and

finished his business, the sooner he could get back to Claudette.

He made the trip in 30 minutes, found the huge sprawling post and turned into the main gate, making a conscientious effort to keep his speed down. Following the route mapped out for him by Major Donaldson, he made a right turn at the first intersection and followed the restricted area signs.

The road divided and wound tighter and tighter, leading him over one hill after another to a remote area. Cresting a rise, he spotted the research center in the distance. Surrounded by hills, it covered acres and was an impressive sight, a huge rectangular building, with smaller wings jutting out from each corner. Even from a distance, he had no trouble making out the words ARMY MAINTENANCE RESEARCH AND EVALUATION CENTER.

He eased the car off the road, braked to a halt and switched off the ignition. He picked up his camera, climbed out, put his eye to the viewfinder, focused and shot. He heard the click of the shutter as he photographed a stoic face. He hadn't intended to photograph the face, but it had suddenly appeared. The face had a towering muscular body. Both belonged to a military security sergeant who eyed him suspiciously. Flanked by MPs on both sides, CPT Watts nodded when the sergeant said, "Come along, sir." It was said politely, but emphatically, and a thick arm reached for the camera. CPT Watts didn't argue.

At security headquarters on the ground floor, CPT Watts presented his ID card and orders and was given a badge and led to the director's office on the third floor. He was greeted by the director, Dr. Seymore. "Sorry you were inconvenienced, but security is rather stringent here."

CPT Watts was relieved. Maybe now he could get the information he had come for and be on his way. Despite his hurry, he couldn't help being curious about his strange surroundings and the equally strange Dr. Seymore. The director resembled a cadaver. He was short and thin, with eyes sunk deeply into dark sockets in his oversized, balding head. But his manner and personality belied his appearance. CPT Watts could sense disciplined responsibility and dedication emanating from the frail figure.

"If you're wondering about this place," Dr. Seymore said, "it's surprising how few people know about us. Yet, there's nothing mysterious or secret about our work."

"Then why all the security?"

"To protect the wealth of information we have uncovered and our highly sophisticated equipment. A fire could wipe out years of research, postpone vital test projects and cost millions for replacements. Some of our equipment couldn't be duplicated at any cost."

"Just what type of projects are you concerned with?"

"We support the Army in all maintenance areas, particularly in aviation safety." Dr. Seymore donned a white jacket. "You'll have a better idea when you see some of our projects and operations for yourself." He pressed a button on a wall panel next to his desk. Instantly, a driverless vehicle, resembling a golf cart, appeared. The forward portion was square and open and it had no visible means of steering. A console, dotted with buttons, knobs and toggles, divided the plush seats. The base of the vehicle appeared to rest no more than an inch above the floor and CPT Watts could see no wheels. While he studied this curiosity, Dr. Seymore stepped into the vehicle and motioned him to follow. "Handy things these Autocarts," Dr. Seymore said, and pressed a button on the console, setting it in motion.

Only a slight hiss was heard as they were propelled along a wide vacant corridor, past a pair of mammoth steel doors. Without further manipulation, the cart stopped at a second set of doors, turned in as the doors slid open and eased itself onto a stage overlooking a vast complex of aircraft. It stopped just short of a railing surrounding the stage.

Dr. Seymore glanced at his watch. "They should be here shortly."

"Who?"

"The new group of Pre-amps."

"Pre-amps?"

"My apologies. I'm getting ahead of you. You see, one of our functions is to study mishap information compiled by other Army agencies, then develop test projects to determine causes and formulate cures. Project Pre-amp came about as the result of a study of mishaps caused by improper maintenance procedures. In this program, we use ROTC students from participating high schools."

"ROTC students?"

"Can you think of a better source? These young men are highly motivated and many will enter military service after graduation. They make ideal subjects and followup evaluations can be continued for those entering service."

CPT Watts heard a buzzing noise and doors slid open on three sides of the complex. A group of 40 to 50 ROTC students and 10 instructors made

its way through each entrance.

Dr. Seymore continued, "We furnish all necessary equipment and instructors for teaching aircraft maintenance at the schools during the academic year, then bring the students here for evaluation and additional training."

"How do they work on aircraft at their schools?"

"They don't. They are taught theory by lectures, mockups and a variety of training aids. Then they work on aircraft sections and components for practical experience. But until now, they haven't touched a whole aircraft. As we'll soon see, this is an important phase of the evaluation program."

CPT Watts watched as the groups broke into teams, each taking its place beside its assigned aircraft. Each team consisted of four or five students and an instructor. The instructors carried clipboards. What attracted CPT Watts' attention most was the manner in which the rotors and propellers were painted. White and yellow stripes commenced from each blade root and flared out, narrowing in width, as they curved around each blade. It was a unique and peculiar design.

"Let's listen in as they become familiar with their aircraft," Dr. Seymore said, and tripped a toggle switch on the console. With a knurled knob adjacent to the switch, he selected a team and tuned their voices in. They heard the instructor say, "These are the Dzus fasteners that you have to keep an eye on. They'll loosen and wind up going through the engine if they're not caught in time."

"Are all these aircraft operational?" a student asked.

"Fully operational, but they aren't flyable in their present configuration," came the reply.

"Well, this microphone won't work. If everything is operational, why won't it work?"

This time there was no quick answer, as if the student was being deliberately ignored. But his voice persisted, "Why won't it work? Why?"

"Because it's a relief tube. Just slip it back in the bracket, son, and we'll continue."

As the question and answer session came to a close, the students, armed with check sheets, began to perform daily inspections. The instructors stood back, observing and taking notes. One student atop a UH-1 motioned for his instructor. Dr. Seymore tuned them in. "How about checking this trunnion bolt? According to the markings, isn't this an aluminum bolt?"

The instructor didn't have to examine the bolt. He motioned for the student to replace it and made an entry on his clipboard.

"See what I mean?" Dr. Seymore asked. "Despite their ages, these boys are sharp. They've learned a lot." Before CPT Watts could speak, they heard the clink of metal striking metal and looked out at the student working on the trunnion. He had dropped the bolt.

Students acting as fireguards were getting into positions for engine starts, while others got ready for their first live starts.

"This should prove interesting," Dr. Seymore said. "Let's see how they do." In short order, the engines roared to life and propellers and rotor blades were seen spinning throughout the complex. Then it happened. A loud explosion was followed by a flash of flame from the tailpipe of a UH-1 and the entire nacelle was engulfed in smoke. The fireguard signaled the operator and immediately moved toward the engine, discharging his extinguisher as the engine was shut down. A second fireguard nearby rushed to help.

"Look out!" CPT Watts yelled, jumping to his feet. "Look out!" But his voice couldn't be heard above the roaring engines. It was too late anyway. In his effort to help, the student had run head-on into a spinning tail rotor.

CPT Watts leaped from the cart, despite Dr. Seymore's attempts to restrain him, and vaulted the railing, landing on the floor below. He saw two medical corpsmen carrying a stretcher as he rushed toward the fallen student. Suddenly he heard and felt a hard thump as an OV-1 propeller smacked across his shoulder. He felt no pain as he dropped to the floor. What happened? he wondered. "I'm still alive!"

Before he could rise, other corpsmen were lifting him to a stretcher. From the distant end of the complex, another report shook the building and smoke poured from a second engine.

Several minutes passed before all engines were shut down and order restored.

"Okay, you can get up now," a voice told the two on litters. The student rose and joined his classmates. CPT watts got up, unsure about what had happened to him. He climbed the ramp to the balcony where Dr. Seymore sat in the cart. "What's going on around here?" he demanded.

"I suppose you could say you've been watching one ring of a three-ring circus. Sit down and let's wait for the tally."

CPT Watts was still examining himself, unwilling to believe that he had run through a spinning propeller and escaped. "Captain," Dr. Seymore offered,

"you're in fine shape. We're quite safety conscious here."

"Would you mind explaining?"

"As I told you, the aircraft and supporting equipment here are all live, but they are different. There is no fuel in the fuel cells. We've substituted a neutral solution that looks and smells like fuel but will not burn or produce damage."

"How do the engines run?"

"They don't. Not really. The sounds are created electronically. Propellers and rotors turn by concealed electric motors and actually rotate very slowly. The special painting gives the illusion of speed. All rotating foils are made of treated balsa that is tough to the touch but produces no more damage than a rolled up newspaper. In effect, this equipment is a combination of the real thing and simulation. We call them Exactolators."

"What about the explosions and fires?"

"Flash paper and harmless charges are concealed in all areas that could explode or ignite in any aircraft. Any condition that would cause a failure or fire in flyable aircraft causes these charges to be set off, with the results you've seen. Smoke pellets create the clouds of smoke." Dr. Seymore was interrupted by the sudden illumination of a huge panel that resembled a football scoreboard. Across the top, lights spelled out INSPECTION RESULTS. Below them flashed the words RATING—EXCELLENT.

Through loudspeakers, a voice summarized results: "All deliberately induced discrepancies were found during the inspection phase. These included loose fuel quick disconnect couplings, missing cotter keys, improper type hardware, cracked trunnion mounts, chafed hydraulic lines . . ." A long list of items was recited.

"For their first try, I'd say they did a fine job," Dr. Seymore remarked. CPT Watts agreed.

The scoreboard lights shifted to spell out FORMS AND RECORDS. Again the students were rated EXCELLENT. All blocks, corrective action, symbols, etc., had been properly entered.

MAINTENANCE PERFORMED, the panel flashed. All work had been accomplished correctly and a third EXCELLENT was awarded.

"Now listen," Dr. Seymore said. With that, the lights changed to read PROCEDURES. From the loudspeakers came, "Personal errors have resulted in the following injuries: two fatalities, one student and one visiting officer."

CPT Watts squirmed and reddened. "Perhaps you'll learn more than you came for," Dr. Seymore said. "That's exactly what this project is designed to do, teach us all."

"Equipment damage," the loudspeakers continued. "Two engines destroyed, fire damage to two aircraft, one tail rotor damaged and one propeller damaged. The causes were a bolt dropped during rotor maintenance which was not recovered and passed through the engine during runup, destroying the engine and starting a fire, a screwdriver left in an engine inlet area after maintenance passed through the engine, a repetition of the first accident."

The loudspeakers droned on, "The tail rotor damage and one injury were caused by a student who disregarded safety rules in the vicinity of operating aircraft, during his attempt to help put out a fire."

It was now CPT Watts' turn. "One injury and damage to a propeller resulted from a visitor's effort to help the first accident victim. Safety rules were violated by unauthorized personnel entering a restricted area." There was a pause, then, "All students will assemble in their groups and await transportation to the conference room."

"Ironical, isn't it?" Dr. Seymore asked.

"How's that?" the captain replied.

"How well they've learned. Perfect scores in all maintenance areas, yet they've failed miserably in routine matters."

"Well, they are young. It isn't as if they were already in service."

"True," Dr. Seymore agreed. "They are young, but not as young as we'd like to think. Some are seniors and will be in service within 3 months. In 6 to 9 months, they will be maintaining Army aircraft. All of a sudden, they aren't boys any more.

CPT Watts said nothing. As an aviation safety officer he felt the impact of these words. "What makes men commit the kind of errors we saw?"

"We don't have all the answers yet," Dr. Seymore replied, "but we have learned a lot. These students have not had the opportunity to work under actual conditions long enough to develop proficiency. As a matter of fact, they have been conditioned to react without thinking of the possible consequences of their actions."

"You mean they've been intentionally trained that way?"

"Not at all. Remember, they are young students still in high school. They play football, basketball, and participate in other activities where their training teaches them to act instinctively. For example, what does a football player do if a ball is suddenly fumbled? He reacts automatically to recover the

fumble, although the ball may have been blown dead. He doesn't wait to see if it is dead before he acts. Similarly, he automatically tries to snatch a loose ball in the air. He doesn't try to determine if another teammate has a better chance at it. Sometimes teammates collide and both lose the ball. Their concern is simply to get the job done in a hurry. Consequently, their actions, for the most part, are spontaneous."

CPT Watts' reaction to assist the downed boy had been spontaneous. He hadn't stopped to consider that others were closer to him and that he could offer no more aid than they could have. Had it been a real accident, probably no one could have been of any help. "What about their leaving tools on aircraft, and not recovering the dropped bolt?" he asked.

"Perfectly normal," Dr. Seymore replied. "Their eagerness to put their newly acquired knowledge to work, to please their instructors and to get the job done without delay; these factors and their lack of practical experience make these mishaps almost inevitable. Another purpose of this project is to make them aware of the dangers so that when they are turned loose on operational aircraft, errors will be avoided."

Reflecting on Dr. Seymore's words, CPT Watts could understand their logic. After his traumatic experience of being struck by a propeller, he could never again listen to the roar of an engine without remembering and respecting the dangers of a whirling propeller.

"What you have just seen," Dr. Seymore added, "is a small portion of the evaluation and training given these students. Now, they go to the conference room for debriefing. Everything that happened here has been taped. They'll be able to see and hear themselves, and analyze their actions. Then they'll be ready for additional evaluation phases and specialized training.

"Testing will be done under conditions of inadequate diets, overwork and loss of sleep. It's surprising what effects this type evaluation has on students, when they can experience and see the results for themselves. Even then they find it difficult to believe their proficiency can drop off to such a large degree. It's all part of their training."

"What comes after that?"

"After they see and experience the effects of bad practices, they are given special training that not only teaches them correct procedures, but makes them automatically think during every step of maintenance and after their work is completed. For example, when they finish their training, even the sound of a tool being placed in a toolbox will cause them to account for all tools. The noise of a dropped nut or some other piece of hardware automatically makes them respond by immediately locating and recovering the dropped item."

"Pavlov's dog?"

"Aha! You're a student of psychology."

"Not really, but I remember studying about Pavlov's conditioned reflex experiments with his dog."

"Exactly! He did it with a dog. We apply the same type of training to humans to produce conditioned reflexes that will result in the best known maintenance practices."

CPT Watts had become so engrossed in the conversation that he didn't hear the hissing of the cart until they were again moving down the long corridor. "Where to now?" he asked.

"To find out about our friend, Meanwell."

"Meanwell?" CPT Watts mentally snapped his fingers. He had forgotten the main purpose of his visit. The cart glided past a second set of sliding doors into a room bare of all furnishings. In the center stood a master control panel. The cart pulled up in front of it, then gently nudged into the panel, like a piece of jigsaw puzzle falling into place. Dr. Seymore turned a dial and a variety of colored lights flashed.

"Meet Robotcomp," said Dr. Seymore. "This is our computer system. It's a little more sophisticated than most. Its equipment is housed in these soundproof walls. Panels can be readily removed when servicing is required."

CPT Watts stared at what he assumed to be a huge overhead light fixture.

"That's our Sam Meanwell bell," Dr. Seymore explained.

Looking closer, CPT Watts saw that it was a bell, surrounded by opaque glass panels, giving it the appearance of a light fixture.

"It's connected to our warning panel," Dr. Seymore continued, "and to similar ones in maintenance offices all over the world. Any time a Meanwell caper occurs, alarms are set off and the bell clangs. We hope this will help us locate Meanwell. We've got to find him!"

A drawer in the master control panel of the Robotcomp suddenly slid open before them. Dr. Seymore reached in and brought out a plastic binder. "This is the Meanwell index."

"Index?" CPT Watts asked. He stared at the binder which was at least 4 inches thick.

"Yes, I'm afraid the Meanwells have been active

for a long time." Dr. Seymore swung the cover open and CPT Watts' eyes fell on this entry: ROME: PISA, LEANING TOWER OF. Across from it, he read: SALOONO A. MEANWELL, LOG 05123490, CODE 112307951.

"Saloono A. Meanwell?" CPT Watts was incredulous.

"That's right. He was the supervisor in charge of laying the foundation for the tower. We have a complete file on him. Our researchers did an especially thorough job on this one. The Meanwells have made history. As a matter of fact, one of our own national shrines resulted from the Meanwells." He flipped the pages of the index to the B's. "Here it is," he said, pointing a finger at this entry: BELL, LIBERTY—SIMPLETON A. MEANWELL, LOG 10921144, CODE 212370519.

"You mean?"

"Without doubt! Simpleton A. Meanwell was assistant to the chief metallurgist who cast the Liberty Bell. The files are filled with similar case histories."

"How far back do you go in your research of the Meanwells?"

"Here, I'll show you." He thumbed through the pages, stopped, dialed some digits on the control panel and depressed a button labeled *file*. In a matter of seconds, a metal box appeared in the drawer before them. Dr. Seymore lifted the lid, pulled out a manila folder, opened it, sifted through the pages and handed it to CPT Watts. "Who do you suppose shod the horse that lost a nail, that lost a shoe, that caused a war to be lost and a kingdom to fall?"

CPT Watts shook his head in disbelief, but Dr. Seymore shoved the file into his hands. On the edge of the folder, he made out the name STABLEMATE A. MEANWELL, BLACKSMITH. Inside he read, "After we became familiar with the local terrain, we set about the difficult task of detecting the true cause of the catastrophe. Using our handtools to clear away obstructions on the path taken by the rider, we uncovered the imprint of a hoof. As shown by the hoofprint (woodcut 1, tab 4) the horse was heading in a northerly direction. This was determined by the fact that the open end of the horseshoe faced south, while the closed end faced north. Spurred by this finding and hoping this imprint was from the horse in question, we redoubled our efforts. Julius Barefoot was sent ahead, while the remaining members of our party fanned out in formation, scanning the path while dangling loadstones before us.

"Our efforts were rewarded by the discovery of additional hoofprints in the clay. Astig Matus saw that one hoofprint varied in appearance. This variation was traced to a loose nail, which was picked up, with no little discomfort, by Julius Barefoot. The nail conformed to FSN 1111-111-11-1 and appeared to be of the type used to shod military horses.

"Captain Abacus, CE, stated that his computations clearly showed that the loss of this nail created undue stresses on the remaining nails, which caused them to loosen and resulted in the loss of the shoe. Resuming our search, we found hoofprints lacking the outline of a shoe. In addition, the horseshoe and additional nails of the same type were picked up by our loadstones."

"That's not all," Dr. Seymore said. "Take a look at this portion of the laboratory analysis."

CPT Watts read: "Subject nail was received by the laboratory and Dr. Alchemist, chief, Nails Division, stated conclusively that the nail did conform to FSN 1111-111-11-1. Marks on the nailhead indicated that an oversized hammer was used, causing the nailhead to flare and the shank to bend. These combined to prevent sufficient penetration for the shoe to be retained. Kindly inform Julius Barefoot to report to the dispensary immediately. This horse was not particular about where he walked."

"Tragic!" Dr. Seymore exclaimed. "An entire kingdom lost to a Meanwell fiasco." He placed the folder back in the box, secured the lid and depressed a button. The box disappeared.

CPT Watts hadn't bargained for all he had found at AMREC. Much of what he had seen and heard appeared sheer fantasy. Yet some was plausible and deadly real. If Dr. Seymore was right and this was a three-ring circus, he had a third ring to see. Suddenly, the room vibrated with ear-piercing clanging sounds. Blue and white lights flickered in cadence with the bell. CPT Watts sat motionless, watching for some reaction from Dr. Seymore. There was none. The flashing lights and noise stopped as abruptly as they had begun.

"This was just a test of the Meanwell warning system," Dr. Seymore said. "We make a test every day at noon." Without offering further explanation, he pressed another button on the cart and they began to move.

"Are you hungry?"

With all he had experienced, CPT Watts hadn't thought about food. "I could use some coffee."

The cart moved through the corridor to an intersection, turned left and passed through an open

archway into a large room where similar carts were parked in long rows. It eased into an open space between two carts and stopped. Climbing out, they strode into a crowded cafeteria. With the exception of the Pre-amp group, this was the first time they had been near other people. The cafeteria was the only place they had been which was not automated. CPT Watts felt relieved to see other people and hear their voices. As they walked down the long line, he saw a wide variety of meats, vegetables, salads and desserts. He inhaled the aroma of fresh baked bread. "I think I'm hungry after all."

Dr. Seymore smiled. "I thought you might be."

CPT Watts pushed his dessert away and sipped his second cup of coffee. "That was great." He looked across the table to his host. "What's the latest on Meanwell?"

Dr. Seymore returned his cup to its saucer. "Meanwell, or Sam as we refer to him here, has been responsible for two destroyed aircraft, the transfer of one highly skilled mechanic, the shelving, perhaps permanently, of a bold new concept in maintenance and he has cost the Army more than half a million dollars. What's worse is that he doesn't realize he was responsible for these losses and we don't know where to find him."

"I can't understand how a man as stupid as Sam must be ever got in the Army."

Dr. Seymore started to lift his cup, then put it down. His voice was deadly serious. "Sam is anything but stupid. His IQ is above average and he's a willing worker, dedicated to his job. However, he's sick and his disease is contagious. That's why we must find him as soon as possible."

"What is his disease?"

Motioning for CPT Watts to follow, Dr. Seymore rose and walked into the kitchen. He took a carton of eggs from the refrigerator and moved to the sink. He lifted an egg, held it, then allowed it to slip from his fingers and splatter in the deep sink. He then repeated the procedure. Lifting a third egg into position, he turned to CPT Watts. "What would you say is going to happen when I release this egg?"

"Obviously it's going to break like the first two."

The Meanwells have made history . . . one of our own national shrines resulted from the Meanwells

"Obviously, you say? Why? Even if you had never seen an egg before, you could reasonably expect other eggs to break after watching the first two fall and break. You see, we are pragmatic in our reasoning. This is how we learn. We know now that if we don't want an egg to break, we must handle it gently. The same thing applies in maintenance, as well as in any other type of training. It's how we learn correct methods."

"Then why don't people follow correct methods? Why doesn't Sam follow the procedures he was taught?"

"Aha! That's just the point. Somewhere along the line, Sam broke a rule. Perhaps he didn't use a torque wrench because he was on a rush job or maybe he didn't replace a worn Dzus fastener because the aircraft was scheduled for an immediate flight. There are hundreds of *maybe's*. At any rate, Sam deviated from correct procedures and there was no accident, no mishap of any kind. He found he could get by with shortcut methods. It's the same as the drop-the-egg routine, only in reverse. Soon, like an alcoholic, he became addicted. Inexperienced mechanics who worked with him adopted his methods and the habit spread.

"But how did he get by for so long?"

"Simple. Strike a match, blow it out, then throw it on the grass. What happens? Probably nothing. You might spend all day doing this without anything happening. But under the right conditions, one match can glow enough to ignite dry grass or straw and cause a forest fire. It not only can, but does, frequently. In Sam's case, his bad habits caught up with him. But he doesn't realize it."

"What do you intend to do with him when you find him?"

"Cure him."

"How?"

"Our medical research division has finally developed a serum that can cure and prevent the spread of Sam's disease. We call it selectitraintrisupervate, or STS for short."

"STS?"

"Yes. You see this miraculous compound has the remarkable ability to influence the brain and blot out bad habits developed over a period of years. As a preventive, STS blocks formation of bad habits. In addition, STS renders the mind receptive to further training and causes the individual to act as his own supervisor when performing maintenance."

"If that's the case, you haven't any problem. Why not innoculate all maintenance personnel?"

"I wish it was that simple. Unfortunately, the present method of producing the serum requires months for a single dose. And, even under refrigeration, the serum has a short life span. It is taxing our facilities to the limit to maintain enough for one dose. That's why we need to find Sam. It's the reason for our Sam warning system and why we are clamoring for assistance from all aviation units. Eventually, we hope to produce the serum synthetically. Until then, our only solution is to cure Sam." Dr. Seymore glanced at the clock on the wall. "We're going to have to move along. It's almost time for Major Hammer's appointment."

"Who is Major Hammer?"

"He's the officer who is going to tell us about Sam's latest escapade.'"

They boarded the Autocart and soon came to a door marked PSYCHIATRIC SECTION. Stepping out, they walked into a small room containing a studio couch and coffee table, on which rested a small control box labeled MONITOR. Leather chairs flanked the couch. Dr. Seymore sat on the couch and flipped a switch on the monitor. CPT Watts selected a chair.

"We should hear something shortly," Dr. Seymore remarked. He had hardly spoken the words, when they heard the sound of a door opening through a speaker concealed in the coffee table. The sound was followed by a voice, "Good afternoon, major."

"That's Dr. Probich, our chief psychiatrist," Dr. Seymore whispered. "Major Hammer has just come in."

CPT Watts had become accustomed to the unbelievable. Nothing he could see or hear could possibly surprise him. Probably the third ring, he thought.

"How do you feel today?" Dr. Probich asked.

"Fine. Just fine," came the reply.

"Excellent. Sit down. Let's briefly review your situation. You are the commanding officer of an aviation company—"

"Was," the other voice broke in.

"My mistake. You were the commanding officer of an aviation company, and you had formulated plans for a new concept in maintenance support. Is that correct?"

"Right. I had the idea that an aviation company could support its own aircraft through fourth echelon maintenance. In that way, aircraft and engines would not have to be removed from the unit, saving time. The practice of pulling running PEs could be discontinued and, under unit supervision, the quality of maintenance could be improved."

"You planned all the details yourself, including all the equipment, tools and supplies needed."

"Yes, but I had the engineers help design a portable hangar that could be readily disassembled for use in the field. Aside from that, I guess I did all the planning."

"You worked on this concept for more than 2 years."

"Yes. Then I had the problem of trying to get approval to test it."

"But you did get approval, didn't you?"

"Yes. It was called Project Ramrod. However, for test purposes I was to use an existing hangar from which we were to operate as though we were in the field. If the experiment proved a success, funds were to be provided."

"I understand there were certain stipulations you had to agree to before you could get approval to test your theory. Is that correct?"

"Yes. The hangar assigned us was also used to house the general's U-8 and we were required to maintain it and some other aircraft, as the need arose."

"What about maintenance equipment and personnel? Were you given what you needed?"

"The equipment was a problem, but we were going to get what we requested. My biggest concern was finding a hangar chief. Like an answer to a prayer, that's when the sergeant walked in."

CPT Watts detected a faint quiver in the major's voice at the mention of the word sergeant. "Meanwell?" he asked. Dr. Seymore nodded.

The voice continued, "He was a young man, in his late 20's or early 30's with average height and build. He had brown hair and light brown eyes. There was nothing to distinguish him from others his age. In a business suit he might have been a young executive. In an Army uniform, in my hangar, I knew he was going to be my hangar chief. His records were outstanding. He had gone through just about every maintenance course the Army offers. He'd held every kind of maintenance position from line mechanic to supervisor. He'd served in Europe, Korea and Vietnam and earned many awards and decorations. He was my answer. Somebody must like me, I thought at the time. Sometime, somewhere, I must have done something good. Without doubt I had found my hangar chief."

"All right, major. You got your man and you were ready to put Project Ramrod into action. Now, I want you to lie on the couch and give me every detail of what happened from that point on."

"But I've already done that a dozen times. Every week, it's the same thing. Repeat. Repeat. Repeat. Must we do it all again?"

"We must if we're going to find out what's bothering you."

"Nothing is bothering me. I'm perfectly normal."

"Fine. Tell me, then, what happened the last time you saw Samson A. Meanwell." Dr. Probich's voice was demanding.

No sound came out of the speaker. After a long pause, Dr. Probich asked, "Why are you sweating?"

"I, uh, I—nothing happened the last time I saw Sergeant Meanwell. I, uh, I mean I don't remember. I don't know! I can't recall!"

"Relax, major. Remember, you're ready with Project Ramrod. Proceed."

"I made him hangar chief and introduced him to every man on the team. I told him how much this project meant to me and how much it might mean to the Army. 'Don't worry about a thing,' he assured me. 'I guarantee you'll get your new hangar.' I remember it clearly. We were in front of the general's plane when I left him."

"Close your eyes and relax."

"Yes, relax. I didn't see him after that," his voice dropped to a whisper, "until it was all over."

"All right," Dr. Probich coaxed, "tell me what happened."

"I'm not completely sure what happened. I was satisfied that everything was in order and I left for Washington to arrange the final details for Project Ramrod. Everything was apparently operating smoothly until a young mechanic had a problem with the spark plugs on the general's plane. Someone failed to coat the threads with oil or overtorqued the plugs. They wouldn't budge.

"That's when Sam went into action. He pulled out his pocketknife, opened it and slit a section from a cardboard box. With some masking tape, he fashioned a funnel, fitted it over one of the plugs, then went after a $CO_2$ extinguisher. He shot $CO_2$ into the funnel around the plug, took the mechanic's socket wrench, gave the plug an easy twist and it came right out. He did the same with the rest and soon had all the plugs removed."

"Was that all?"

"No. That's when the trouble started, right after the mechanic got a new set of plugs. He started toward the cleaning area, intending to flush the plugs, dry them and check the gaps. Sam stopped him and delivered a lecture about wasting time. He got a bucket, stooped under the U-8 and began

draining fuel. When he had filled the bucket, he started back. I guess he was in a hurry and sloshed some fuel on the floor. The mechanic was about to go after a mop, but Sam stopped him again. The way I got it, his words were, 'Don't bother. You'll only waste more time. By the time we clean these plugs, most of it will have evaporated anyway.' "

"Didn't the mechanic tell him this was against safety rules?"

"He tried to, but Sam told him, 'Nonsense! I've been doing this for years!' It was about this time that the general's wife came in. She had dropped by to check on the plane and to show me Contessa, her French poodle. She didn't know I'd already left for Washington. Poor Contessa."

"What happened?"

"Contessa was to have been entered in a dog show and the veterinarian had just finished grooming her. They tell me she was a beautiful sight. The general's wife was mighty proud of her."

"Go on."

"Contessa strayed over to the general's U-8. By this time, Sam had finished cleaning and installing the plugs. He decided he should pull an ignition check. Nothing was too good for the general. He brought in the ignition tester, set it on a portable stand and plugged it up. Unfortunately, the hot lead was dangling and accidentally touched Contessa's tail."

"And?"

"They told me her eyeballs caged, her tail stiffened and she was transformed into a raging mad dog. Maybe the mechanic was standing too close. She apparently blamed him for her troubles and bit into his leg. He reacted by high jumping the tail boom of an OH-13. Sparks from the dangling lead ignited the spilled fuel and the U-8 was engulfed in flames.

"The mechanic sounded the alarm and raced after the extinguisher, only to find it empty. Before anyone could stop him, Sam grabbed a water extinguisher from the office and turned it on the burning fuel. This spread the fire and they had to abandon all attempts to save the general's plane and the OH-13. The whole hangar burned to the ground, with all our equipment!"

"Were there any injuries?"

"No. The general's wife had to be put under sedation and the dog got a mild singe. The mechanic was treated for dog bite and released. But we lost him."

"How?"

"When the post athletic director heard about his athletic ability, he called him in. I understand we may have a champion high jumper in the next Olympics."

*Supervision was the ingredient which could make or break a training program. Without it an entire course would be doomed to failure*

"Now, Major Hammer, we've come to that part again. What happened between you and Sam?"

There was no reply. "Major Hammer, you've got to get it out of your system. You've got to tell me. Think, man, think! Once you get it out, you can be your normal self again. You'll never quiver at the thought of Meanwell again."

Slowly, MAJ Hammer's voice began: "I had just returned from Washington. Sam was waiting at my quarters. I found an envelope tacked to my door. It was from Major Blower. We're old friends, but we've played oneupsmanship since we were lieutenants. I'd always gotten the better of him. I invited Sam in and opened the envelope. The note inside read, 'Congratulations on your new hangar.' That's all. If I'd only thought, I've have known it had to be sarcasm. Instead, I assumed approval had been granted for construction of the portable hangar. I was overjoyed!"

"What about Sam?"

"Sam had come to say goodby. He said he'd been assigned to us in error and he had a set of orders. It nearly broke my heart. All I could think of were the words he said when I made him hangar chief. Remember? He said, 'I guarantee you'll get your new hangar.' After reading Major Blower's note, I assumed Sam had been highly instrumental in getting approval for the portable hangar, and—" His voice trailed off.

"Don't stop now," Dr. Probich urged. There was no response.

CPT Watts heard some incoherent mumblings, then, "Out with it, man!" Dr. Probich commanded.

Slowly, MAJ Hammer continued, "I didn't know what to say to Sam. I hated the thought of losing him, but he had his orders, so," he stopped again.

This time there was no urging, only silence. Then, like a dam suddenly bursting, he blurted out, "I wrote him a personal letter of commendation!"

CPT Watts was pressed into his seat as the nose of the DC-8 pointed skyward. Fort Bastille lay below and he could see the huge structure that housed AMREC. The activities of his strange day flowed through his mind. They all seemed utterly preposterous—Autocarts, Exactolators, Robotcomps and STS serum. Yet, some of it was plausible.

Selectivity. It made good sense to be selective in accepting personnel for maintenance training and in assigning trained mechanics to specific duties and functions. One man may be very capable in performing line maintenance. Another might do better in the shops. Yet, neither might make a suitable crewchief. A good crewchief might prove unsuitable as shop foreman or hangar chief. Equally important were job assignments on the basis of training and experience on type aircraft, rather than solely on seniority.

The DC-8 climbed steadily as CPT Watts continued to mull over Dr. Seymore's revelations. A man is taught what to do and how to do it correctly, but training must accomplish more than that. Equipment and procedures change. What was true for one engine yesterday is not necessarily true for another engine today. Formal and OJT must be a continuous operation.

"Could supervision be more important than selectivity and training? True, supervision was involved in every maintenance area. It was the determining factor in selecting and training personnel, and in determining proficiency and capabilities of individuals. Supervision was the ingredient which could make or break a training program. Without it, a lesson plan or an entire course would be doomed to failure. The whole training program, classroom or OJT, depended on supervision. Supervision was imperative for the success of any phase of maintenance, from insuring accurate forms and records to completion of specific maintenance work.

CPT Watts felt the change in attitude as the aircraft leveled off and entered cruise flight. Outside, the sky was bright, while darkness was rapidly enveloping the ground below. He took a last look back toward the now distant fort and thought of Dr. Seymore and AMREC.

His ears began to ring, a ringing that gradually began to amplify. He opened his mouth and swallowed. It didn't help. The sound grew louder and louder. He cupped his hands over his ears and tried swallowing again. Nothing helped. Suddenly, over the spread of darkness below, lights began to flash, blue, then white. The entire countryside appeared trapped in a freakish lightning storm.

The ringing reached a level that made him want to scream. Suddenly he knew what it was. It was impossible, but it was happening. The Sam warning system had been activated. Somewhere, Meanwell had struck again. They were flying at 35,000 feet, but the lights were flashing and he could hear the bell as well as if he were in the room with it.

He pushed himself back in his seat, buried his head in the pillow the stewardess had given him and closed his eyes tightly. "Stop! Stop!" he wanted to shout, but the ringing continued and grew louder as he twisted and turned. Then, sudden blessed silence. He opened his eyes hesitantly, but all he could see was a blurred mass. He blinked his eyes several times in quick succession. Like a telescope coming slowly into focus, he began to make out forms, unintelligible at first, then they began to clear. He could still feel the softness of a pillow and he was certain he smelled a delicate perfume.

MAJ Donaldson was the first person he could identify. He was kneeling before him on one knee and he felt his hand pressing a wet handkerchief to the side of his head. Then he realized he was lying on the floor with his head cradled in someone's lap. Puzzled, he didn't move, wondering what was happening. Then he saw a young boy clutching a golf club and staring at him in wide-eyed fright. It all came back. He grinned to reassure MAJ Donaldson's frightened son.

"You okay, Ben?" MAJ Donaldson asked.

"Yes, sir, I think so. With a drive like that, you should put him on the pro tour. He glanced up at the owner of the lap and saw feminine eyes staring at him. So this was where the perfume was coming from. He studied the youthful face surrounded by blonde wavy hair. It was filled with the vitality and sparkle of her age, and the green eyes reflected tenderness and concern for him. Although new to the department, he wondered how he could have failed to notice such a lovely face.

His thoughts were abruptly interrupted by a word that thrashed into his mind—SELECTITRAINTRISUPERVATE—STS—selectivity, training and supervision. He must remember. This was the key to successful maintenance. His eyes were drawn back to the girl. He wouldn't forget. Just below her left shoulder, he read, *Miss Stella T. Singlehart*. He had found his answer.

# USAASO Sez

## The U. S. Army Aeronautical Service Office discusses

Air traffic controller personnel records
Reporting missed approaches
SIGMETS and AIRMETS
ATC and NAVAID facilities

**Air Traffic Controllers:** Since January 1969 your MOS has been controlled by the Special Category Branch of OPO. This in itself has many advantages, provided the rules of AR 600-200 are followed. So often, the personnel sections are overloaded with work to the point where a few items can slip by undone. You can help your friendly personnel officer and yourself if you will perform a few important tasks:

- Review your Form 20.
- Be certain all qualifications are listed.
- Sign two copies of Form 20 (one must be forwarded to Special Category Branch of OPO).
- Maintain a current DA 2635 (preference statement) on file in OPO (for all grades/rank).
- Changes in status must be reported to OPO on DA 2876 (promotions, reductions, medical limitations, etc.).
- Forward PCS Orders to OPO. (This keeps the assignment team knowledgeable of your whereabouts; also enables them to project future assignments.)

**On Missed Approach:** When an aviator executes a missed approach, he is expected to inform the air traffic controller as soon as practicable. He is also expected to inform the controller of his intentions and be prepared to file a flight plan by radio if flight to an alternate or clear area is necessary. If fuel and other considerations permit, aviators may request additional approaches (any type procedure) prior to filing for an alternate. It is not unusual to be required to change radio frequencies due to congestion or having flown into an adjacent controller's area of responsibility. If radio contact is lost during the changeover, go back to the original assigned frequency unless other options are apparent. It's always good practice to monitor local navaids not used in the approach for orientation and emergency purposes. Plan in advance what you should do in the event of missed approach! Be prepared to adjust for local traffic separation as dictated by the area controller in his clearance. Be careful not to accept a clearance with which you cannot comply.

**What is SIGMET or an AIRMET?** The U. S. Federal Aviation Administration provides information on hazardous weather through its flight service stations to all aircraft in flight. These inflight safety advisories, designated SIGNETS and/or AIRMETS, are broadcast on enroute air ground radio channels. SIGMETS include significantly severe meteorological phenomena while AIRMETS report weather conditions of less severity but of operational interest to all aircraft. Refer to FLIP Planning Document, Section II, pages 9-11, or the FAA Airmen's Information Manual, Part I, pages 32-33, for further details on broadcast times and coverage.

**Got your neck stuck out on ATC and NAVAID facilities?** Better check your agreements with the FAA concerning your ATC and NAVAID facilities in the National Airspace System (NAS). Army facilities in the NAS are required to adhere to the provisions of TM 11-2557-28, U. S. Interagency Ground Inspection Manual, dated April 1967. Copies of this manual are available from USAASO.

# Army Aviation Aids Camille Victims

ARMY AVIATION units from Ft. Rucker, Ala., and Ft. Benning, Ga., have played a leading role in aiding the victims of Hurricane Camille which devastated the Gulf Coast area of Mississippi with 200 mph winds and raging tides last August.

Members of the 53rd Aviation Battalion, 177th Aviation Company and the 197th Aviation Company arrived on the scene soon after the winds had subsided and made themselves available to help the victims of what has been described as the worst hurricane ever to hit the U. S. mainland.

LTC Dudley Carver of Ft. Rucker, officer-in-charge of the Army aviation rescue organization, immediately ordered an aerial reconnaissance made of the area between Ocean Springs and Waveland, Miss., to determine the extent of the damage. This assessment was urgently needed by the Red Cross and the Civil Defense for planning purposes.

LTC Carver, a native of Biloxi, said, "We found Waveland to be 100 percent destroyed, Bay Saint Louis 80 percent lost and Pass Christian to the western limits of Long Beach almost all gone. I don't recall seeing a house standing. Long Beach itself was 60 percent damaged with the west side of Gulfport 20 to 30 percent destroyed. All the beach area from Gulfport to Biloxi was non-existent for the first two blocks from the seawall inward."

The Mississippi National Guard moved into the area and proceeded to evacuate the homeless that could be reached by trucks and other conventional means of transportation. Army aviation units flew into areas that could not be immediately reached by land transportation to rescue the needy. In less than four days over 500 people had been evacuated in Army aircraft.

As an example of the services performed by aviation, LTC Carver said, "CPT John P. Diggs from Ft. Rucker and I went into the Bay Saint Louis-Waveland area and found 25 homeless families who had not eaten in three or four days. We brought in food and a medical officer and when an aircraft of sufficient size was available, we brought the people out."

At another time CPT Diggs flew out over the gulf and reported seeing a two-mile-long floating island of twisted debris dotted with bodies. He said that he made several passes over the island and counted about 40 bodies.

Army aviation performed a wide range of missions including medical evacuation, resupply of food and water, refugee relocation plus search and rescue operations. A large part of the food and medical supplies needed by the hastily established distribution points was transported by Army aviation.

prepared by the U.S. Army Board for Aviation Accident Research